MISTAKES AND ACCIDENTS OF SURGERY

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BY

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LONDON

BAILLIÈRE, TINDALL AND COX

8, HENRIETTA STREET, COVENT GARDEN, W.C.2

1923

PRINTED IN GREAT BRITAIN

PREFACE

SEA captains of old sailed in waters that were uncharted. Their guides were nebulous and doubtful; their dangers great. The steep coast, the gently shelving shore—such poor marks as these—interpreted to them, vaguely and with much hazard, what now is told truly and surely in the chart house.

The surgeon of to-day is like the sailor of a past age. He, too, is embarked upon oceans that are unmapped and wide. For ever, and with much labour, feeling his way with the lead, as it were, he is beset with incessant troubles. Innumerable are the surgical disasters with which he is menaced, unnoticed or unrecorded are their causes, unavoidable their repetition. My aim has been to make a commencement of better things by locating some of the danger-points in the universe of surgery. The charting I have accomplished is rough and imperfect—almost absurd maybe—like the early maps of the world in its simplicity and crudity. Nevertheless, there is a value in the ill-shapen beginning of a thing, for we know that all the complex tracery of completion will come about eventually as the gift of time.

My trust is that surgeons of the future will have many beacons to guide them which we of to-day do

not possess. I am conscious that my enumeration disasters and misadventures is of staccato effect a lacks cohesion. But the catalogue of errors is a lengt one; and to mention all and moralise on each would tedious and wearisome. All that I hope to accompli is to save some surgeons, and some patients too, fr wreckage, and to arouse and fertilise the imaginatic of those who care to read and earnestly to think. A if anything that I say should bear the appearance arrogance or conceit, let me publicly confess that tl book has arisen from a sorrowful contemplation of t many surgical errors which I have myself committed.

H. B.

PORTSMOUTH,
November, 1922.

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Section I. HEAD AND NECK

CHAPTER I

HEAD INJURIES

More than two thousand years ago, Hippocrates declared that there was no head injury which was so trivial that it could be despised. The maxim that he uttered then has an equal force to-day. And yet men do not always base their practical conduct upon this safe foundation laid down by the father of medicine. How often do we hear that so-and-so is suffering only from slight concussion and will be well in a day or two?

A man sustained a fall from his horse, receiving a contused and slightly lacerated wound of his left forehead and supra-orbital ridge. When seen by his doctor he had drunk a stiff whisky and soda, and was unnaturally excited and talkative. The opinion was expressed that "he had better keep quiet for a bit and he will be all right." It soon became obvious, however, that the diagnosis and prognosis had been too optimistic, for the patient remained excitable and strange

in his manner for a considerable time, and moreover became completely blind *in the left eye from atrophy* of the left optic nerve.

The fact is that a severe cerebral injury is not always manifested by obvious and tangible signs. This being so, the medical man from the first should avoid the pitfall of cheery optimism. Some years ago there was a great outcry in the London newspapers about "Drunk or Dying" cases. There happened to have been several inquests within a short period of time upon individuals who had been taken to one or another hospital by the police and who had been regarded as "drunk" by the house surgeon on duty, and who consequently had been refused admission. Some of these had died in police cells, some elsewhere. Post-mortem examination revealed cerebral lesions, in certain instances accompanied by a fracture of the skull. These calamities were in part attributable to the fact that few of the hospitals in London made any provision of an observation ward in which this class of patient might be retained; and there was a natural reluctance to admit a patient who probably would be rowdy into a general ward where he might disturb the rest of the patients and deprive them of sleep. This was one explanation of, and reason for, the scandal. The other was the failure on the part of the house surgeons concerned to realise that the symptoms of a sudden brain lesion—whether due to trauma or to disease—may be indistinguishable from the symptoms of alcoholic intoxication.

Even in the absence of any history or objective

evidence of injury it is incumbent on the medical man in every case of this sort to give the patient the benefit of the doubt and to await the revelations of time. In no other way can lamentable errors be avoided.

The next point to which attention may be called concerns the after-treatment. Prolonged rest from all intellectual and bodily activity is compulsory in every case in which the brain has received a physical insult. This trite assertion is rendered necessary by the fact that the principle is so often ignored. One has known a man treated in the most cavalier fashion, having been allowed to get up and try to go about his business in spite, not only of a recent brain injury, but of a fractured skull also—with consequences that were exceedingly troublesome both to the patient and to his medical attendant.

A partial explanation of such delinquencies probably is to be found in the fact that a fracture of the skull looms so much more largely in our textbooks and in our minds than does a lesion of the brain. The former is more objective and so is more readily visualised. Unconsciously, therefore, the doctor devotes his effort to a recognition of the presence or absence of a break in the cranial bones, and failing to find one is apt somewhat to overlook, or at any rate to pay too little regard to, the more important question of the possible presence of damage to the cerebral tissue.

It is proper, of course, to discern a fracture of the skull when such a lesion is present; and, therefore, good radiograms should be obtained in every case of doubt

whenever it is possible to do so without injuring the patient. The information so acquired is not only a useful guide as to the amount, locality, and nature of the trauma received by the brain, but it is of help also in controlling the patient and his relatives; while it protects the surgeon. For not unnaturally the public regard it as inexcusable for a doctor to overlook a fracture of the skull through the omission of a method of diagnosis which is obvious even to the laity.

Nevertheless, one is compelled to insist upon the fact that serious bruising and laceration of the brain, demanding prolonged and careful after-treatment and a cautious prognosis, may come about in the absence of any fracture at all.

Of the two chief causes of disquietude in dealing with cranial injuries, this one of *the presence of actual damage to the brain* has been sufficiently dealt with for the present.

The other remains for consideration. It is the *possibility of infection gaining an entrance through a break in the continuity of the normal coverings of the brain.* Such entrance may come about by means of a conspicuous passage, as in a compound fracture of the vault; or the channel may be less obvious and less direct, as in fissured fractures which pass through the middle ear or through the frontal or sphenoidal sinuses, or the roof of the nose.

So far as errors in treatment are concerned there is something to be said regarding (*a*) fractures of the base of the skull accompanied by rupture of the tympanum, and (*b*) compound fractures of the vault.

When the petrous bone is fractured and the tympanum is torn there is an obvious channel by which infection may pass from the external ear, through the rent in the drum, into the middle ear and along the fissure in the petrous bone to the cranial cavity. At first thought, therefore, it seems rational to try to disinfect the external auditory meatus, by clearing out the blood clot and by syringing with antiseptics. Experience, however, has shown that such efforts are dangerous and are more likely to result in the spread of sepsis than in its avoidance. And especially perilous is it to utilise hydrogen peroxide for the syringing. Accordingly no untimely poking about in the external auditory meatus must be indulged in. Masterly inactivity is the best course here.

Compound fractures of the vault may be considered under two headings. The first includes those cases of simple fracture which are converted into compound fractures by operation—that is to say, the uninfected cases; while the second comprises the remainder—the infected ones.

When we operate with a view to elevate the fragments in a simple depressed fracture, it is likely that we shall find the dura mater—supposing this to be intact—bulging into the trephine hole. The temptation may then seize us to incise the dura in order to relieve the tension. This temptation is for ever to be avoided. A bulging dura is not an indication for an incision; it is an indication merely for lumbar puncture. Above all is it a mistake to open the dura and drain the arachnoid

space. Here is a brief illustration abstracted from the literature: [1]

"The dura mater was opened and some blood evacuated from beneath the dura mater, and a small gauze drain left through the dura mater. No more bleeding occurred, but although the immediate effects of the operation were good, the child died, apparently from the escape of cerebro-spinal fluid, which was profuse and continuous."

In dealing with ordinary, that is to say infected, compound fractures of the vault, it is necessary to keep clearly in mind what are our primary objects. These are to eliminate all sepsis from the wound, if this be possible, by excision, and then to effect complete closure so as to leave no track behind for the subsequent entry of the organisms of infection. If the wound cannot be closed completely on account of its extent, then flaps *should be arranged so as to close over the gap in the* bone, the remaining raw surfaces being placed as remotely as possible from this region.

Above all things, in these infected wounds, no inducement should lead the surgeon to open the dura. *An intact dura is one of the best prognostic features* in a compound fracture of the skull.

Before concluding this general consideration of head injuries it may be worth while referring to the possible error of assuming that the inner table is sound because no fracture can be detected in the outer table. It is, of course, well recognised that a fracture of the inner

[1] *Lancet*, Jan 12, 1907

table with depression of the fragments may come about in the absence of any break in the outer table. Radiograms are of great value in these cases.

Some questions of difficulty may arise in connection with the treatment desirable for symptoms attributable to injury of the brain by *contre-coup.* Suppose, for example, that a patient has received an injury to one side of his head, and that localising symptoms have appeared pointing to damage of the brain on the opposite side. Ought one to trephine, and if so over what area?

Trephining in such circumstances might be done with the intention of elevating depressed bone, ligation of a bleeding vessel, or the evacuation from the meninges of blood-clot. None of these conditions is likely to be present at the site of *contre-coup.* The changes produced in the brain by *contre-coup* are nearly always lesions of the brain substance, for the most part associated with local softening and either with or without small cortical hæmorrhages; trephining over this area can seldom, if ever, afford relief.[1]

Trephining

In planning the flaps necessary to expose the area of bone that is about to be trephined, it is not wise to forget entirely the structures that may be divided in those flaps.

Ridiculous as it may seem to utter such a simple warning, common practice renders it necessary. For example, the incision usually recommended in the

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textbooks for a subtemporal decompression or exposure of the middle meningeal artery is one which has its convexity upward and which, commencing at the external angular process of the frontal bone, terminates at the zygoma just in front of the ear or on the mastoid process behind the ear.

Now the objection to this incision, as Harvey Cushing [1] has pointed out, is that it necessitates division of the nerves which supply the frontalis and orbicularis palpebrarum. Paralysis of these muscles is followed by an obvious and unpleasant deformity of expression. To avoid this the anterior limb of the incision should commence one inch above and half an inch behind the external angular process of the frontal bone.

The temporal fascia is a strong and useful defence against injury when there is a subjacent gap in the bone, and care should be taken to preserve this function by sewing together the cut edges of the fascia before closing the wound in the superficial tissues. This purpose must be borne in mind when making the primary incision, and the fascia should be cut through about half an inch from its attachment to the upper temporal ridge so as to allow a sufficient fringe of fascia above for the insertion of sutures.

When using a trephine several precautions are to be observed. If there is loose bone in the area to be trephined, as in a fracture of the skull, a small trephine should be employed and it should be applied entirely to the rigid bone at the margin of the fracture. The

[1] *Annals of Surgery*, Jan. 1906.

error of applying the trephine partly or entirely to a loose fragment is apparent when the matter is thought out; nevertheless it is not infrequently committed.

When working the trephine one should avoid the exertion of undue and unnecessary pressure upon the instrument. Trephines used to be cylindrical, and there was then a danger of their slipping into the cranial cavity and causing grave injury to the brain. Nowadays trephines are conical in order to prevent this accident. Still, one occasionally sees cylindrical trephines in hospitals and elsewhere; so the danger referred to is not yet quite extinct. In any case a trephine acts like a saw, and in order to make either instrument cut effectively excessive pressure is not required.

The unpractised operator, and even experienced surgeons when working under conditions of great fatigue, may forget to remove the pin of the trephine, and so cause accidental perforation of the dura. At the present time there are large numbers of trephines being sold—I have seen them in several hospitals—in which the pin is too long, so that in opening the skull anywhere but in the areas where the bone is thickest the pin will penetrate the dura mater before the cutting edge of the trephine has engaged the bone. I have seen a wound of the middle meningeal vein caused in this way.

While the skull is being gradually cut through, an exploring probe should be in frequent requisition to judge whether the bone in any part of the circular cut has been completely penetrated; otherwise the dura mater and perhaps the brain may be injured.

There is a temptation, when the division of bone is nearly complete, to attempt forcibly to lever out the disc with the trephine or with an elevator; if this be done it is apt to cause irregular fracture of the incompletely divided inner table, the sharp edges of which may require a considerable waste of time and energy for their removal.

When an osteoplastic flap is employed it is important to cut the edges obliquely instead of at right angles to the surface of the bone, so that when the bony flap is replaced it cannot cause injury to the brain by becoming depressed. Harvey Cushing[1] used to recommend a hand trephine and Gigli saw in preference to an electrical drill when making an osteoplastic flap. "Having witnessed," he writes, "twice from a Doyen circular saw, and once from a Crile drill, what I regard as a most serious accident—namely, the division of bone and dura at the same time, owing to the fact that the *guide of the speeding instrument worked its way through* the adherent membrane instead of separating it from the skull—I have clung to the somewhat slower, but certainly less dangerous operation by hand-driven instruments."

Sometimes a difficulty may arise in dealing with a fracture of the vault, owing to laceration of the longitudinal sinus. The flow of blood from this vessel is very profuse and is rather apt to upset the mental balance of the operator, who may in consequence resort to the unsatisfactory course of inserting a plug of gauze

[1] Quoted by Rawling in Burghard's "System of Operative Surgery," Vol. III. 1914, p. 211.

into the sinus and leaving it there until thrombosis may be assumed to have taken place. This must never be done, for the upper cortical veins empty into this sinus, complete blockage of which is therefore to be avoided. Consequently, the flow of blood should be checked temporarily by pressure upon the walls of the sinus fore and aft of the aperture, by means of packing with ribbon gauze. Then, if the rent in the sinus does not admit of suturing with fine catgut, the operation upon the bone having been completed the flap of scalp should be brought into place, and just before the last stitches are inserted the strips of gauze should be extracted, light pressure being applied to the surface over the gap in the skull while the last sutures are being put in and tied. Light pressure thereafter will suffice to prevent any subcutaneous escape of blood, and there will be a good prospect of preserving the patency of the sinus.

Before quitting the subject of cerebral injuries, attention may be called to a curious and unfortunate kind of error in the management of certain cases. The patient, a small boy, we will suppose, falls off a wall and suffers from concussion of the brain. He is put to bed and retained there on a low diet consisting in the main of milk and beef tea. After a short period of apparent improvement he begins again to vomit and becomes increasingly drowsy. It is now thought that he must have received some more grave intracranial injury than had been supposed. Consultants are summoned and are at a loss because there are no localising

symptoms. Lumbar puncture is performed but yields no information of value. Every one is worried. At last somebody hits on the idea of examining the urine for diacetic acid, which is found to be present in large quantities, together with acetone. Carbohydrates are administered freely to the patient, who immediately begins to improve and soon becomes well. Unless the condition in question is understood and considered, these patients are allowed to die, and their dissolution is not rarely hastened by the administration of an anæsthetic in order to perform lumbar puncture or for some other purpose; for anæsthetics have a malign influence upon children who suffer from acidosis.

This danger of mistaking dietetic acidosis for the results of a head injury is no fanciful one. I have been called more than once to a consultation on such a case.

CHAPTER II

TUBERCULOUS GLANDS IN THE NECK

I HAVE been told with some emphasis that the removal of tuberculous glands from the neck is an operation that any general practitioner ought to be able to do. Nevertheless, even in experienced hands, these cases are by no means easy to manage with efficiency and credit. The affected glands lie in close relationship with important structures, injury to which can be avoided only by an exact and intimate knowledge of their anatomy combined with considerable skill in surgical dissection.

The three main objects which the surgeon must keep in view are: (1) to obtain a scar which will not be strikingly obvious or unsightly later on, (2) to remove as completely as possible all the affected glands, and (3) to avoid injury to important structures in the neck.

The incision which leaves the best scar is one which lies parallel with the natural creases of the neck, that is to say, it is curved, and commencing at a point just below and behind the tip of the mastoid process it extends downward and forward to the thyroid cartilage. Through this cut the anterior triangle of the neck and the upper part of the posterior triangle as a rule can be

cleared of glands, though it may be difficult or impossible in some cases to deal satisfactorily with the uppermost glands in the parotid region. For the removal of glands from the lower part of the *posterior triangle* a second incision always will be necessary, and this one may be curved and parallel with the former incision, or may be straight and placed along the posterior border of the sterno-mastoid.

The alternative incisions are, one along the front border of the sterno-mastoid for exposure of the anterior triangle, and the other along the hinder border of the muscle to open up the *posterior triangle*. By means of these cuts the difficulty mentioned above, in connection with removal of the uppermost glands, is avoided; and for common use these incisions probably are the best.

Frequently one sees wide and perhaps cheloid scars resulting from operations for excision of tuberculous glands, even when there has been no post-operative suppuration. *These scars are unsightly. And not* only are they unpleasant to look at, but they may be regarded as evidence of unskilled surgery. They are due in some instances to the fact that the surgeon has omitted to sew up accurately the cut edges of the deep and superficial fasciæ.

The deep fascia and then the superficial fascia should be sutured with very fine catgut before the skin is closed. To obtain a neat scar in the neck it is almost as important to stitch the fasciæ as it is to unite the edges of the skin. For the latter purpose clips, or the finest needles and

suture material only, should be used; and they should be removed early—about the fifth day after the operation.

While discussing the subject of scars it may be well to utter a warning as to the length of the incisions. In the hands of the inexperienced these have a tendency to be too short. Minimising the amount of scar tissue is a laudable purpose, of course; nevertheless it is bad economy indeed when it renders the operation difficult, prolonged, incomplete, and not rarely dangerous. It is a more pardonable error to make the incision longer than is needful than to curtail it below the needs of the case. For it is absolutely essential that the surgeon should have an unrestricted view of the structures which he has to dissect. Never must he use the knife in a patient's neck unless he can see exactly what he is cutting. Poking about with the point of a knife in a dark and obscure corner of the wound is to seek for disaster. In a young child I have seen it result in a wound of the internal jugular vein which could not be secured. Hasty plugging with gauze, after excited and ineffectual efforts to grasp the vessel with pressure forceps, failed to save the patient's life.

The second step of the operation, which follows division of the skin and the superficial and deep fascias, is *to define clearly the landmarks and the important structures* injury to which must be avoided. The chief landmark is the sterno-mastoid muscle itself, and secondary ones are the carotid sheath and digastric muscle. Having defined these structures we have satisfactory means of anatomical orientation.

Attention may now be turned to those sp
injuries which the surgeon by inadvertence may i
in the course of the operation.

The Spinal Accessory Nerve frequently is embe
among the tuberculous glands and it may be diffi
especially in the posterior triangle, to avoid cuttin
For this reason it is best to expose the nerve thorou
before commencing to dissect out the glands.
nerve, after passing over the prominent trans
process of the atlas, passes into the deep surface o
sterno-mastoid muscle about two inches below th
of the mastoid process (in an adult) and passes o
the muscle at the middle of its posterior border.
sterno-mastoid branch of the superior thyroid ar
with its accompanying vein, passes into the m
with the nerve to which it is a guide; while a land
for the exit of the nerve from the sterno-mastoid i
point of emergence of the superficial cervical nerv
the posterior edge of the muscle. These nerves
readily seen. The spinal accessory nerve lies about
an inch above the spot where they pass through
deep fascia.

The Nerve of the Depressor Labii Inferioris.—
infrequently paralysis of the depressor labii infe
is met with as a sequel to the removal of tubercu
glands from the neck. This mishap is unlikely to o
if either of the incisions already mentioned is emplo
Nevertheless, the classical incisions are not al
applicable to particular cases, and therefore it is we
be acquainted with the course of the nerve supp

this muscle. The nerve is derived from the inframandibular branch of the facial, whence it passes by an anastomotic connection to the supramandibular branch. The inframandibular twig pierces the deep cervical fascia just behind the angle of the jaw and, running downward beneath the platysma muscle, gives off the anastomotic slip at the level of the hyoid bone. This slip passes up into the face close to the spot where the facial artery crosses the lower jaw.

The Pneumogastric Nerve.—There is no great likelihood of injury to the vagus nerve, but the accident may occur. As Sutcliffe [1] has pointed out, the normal relationship of the structures in the neck is apt to be disturbed when the lymphatic glands become diseased. In these cases the internal jugular vein is liable to be displaced forwards, and the pneumogastric nerve is then brought into the field of operation when deep glands are being dissected away. It has been taught in some quarters that unilateral division of the nerve does not endanger life and may not give rise to any unfavourable symptoms. But this is erroneous, for the resulting paralysis of the recurrent laryngeal nerve must be looked on as a serious misfortune, and there is always the possibility of a direct stimulation of the inhibitory fibres of the vagus producing an immediate fatality.

The Facial Nerve.—In some cases the enlarged glands extend upward to the parotid region, when they may come almost into contact with the main trunk of

[1] *B. M. J.*, Vol. I. 1905, p. 1031.

the facial nerve near the stylo-mastoid foramen. The nerve here is in close relationship with one of the temporo-facial veins. These veins are liable to be injured, and in this case it is easy to put a pair of forceps on the nerve as well as on the punctured vein.[1]

The cervical sympathetic trunk has been said to have been injured in the course of these operations. The symptoms are enophthalmos, drooping of the upper eye-lid, which, however, can be retracted voluntarily to its highest limit, relative contraction of the pupil, which still contracts to light, diminution of intra-ocular tension, and failure of the pupil to dilate in response to the instillation of cocaine. However, as the cervical sympathetic lies behind the carotid artery it is removed from imminent peril.

The Phrenic Nerve should be in no special danger, but Sherren, in his book on the "Surgery of the Peripheral Nerves," refers to its occasional injury in the course of this operation.

Arterial Wounds.—I have seen one instance where death resulted from an accidental wound of an artery. It is true that the mishap occurred during the removal of glands in a case of malignant disease; but there seems no reason to suppose it could not take place during an operation on tuberculous glands. The superior thyroid had been cut through close to its origin from the external carotid artery, and a ligature had been applied to the stump; on the following day a fatal secondary hæmorrhage ensued. Probably it would have been

[1] Sutcliffe, *loc. cit.*

wiser to have tied the external carotid itself at the time of the main operation.

Injuries to Veins.—Venous hæmorrhage is perhaps the greatest cause of trouble during these operations. The veins are numerous, and unless the wound is kept dry and unless a clear view is kept of every bit of tissue that is being cut through, it may be difficult to secure a wounded vein; moreover in grabbing for it with forceps damage may be inflicted upon other structures. The two chief veins to be respected are the internal jugular and the common facial vein, the latter being specially liable to puncture near its point of entrance into the internal jugular. It is advisable therefore at an early stage to endeavour to define these veins completely, so that if they are wounded later on the bleeding may be readily controlled without any unpleasant scramble. To do this in the case of the internal jugular vein it will be necessary to free the digastric muscle and retract it upward. It rarely happens that the glands are actually adherent to the jugular vein so as to necessitate removal of that vessel. By careful dissection the glands nearly always can be separated from the vein. More often than a wounding of the internal jugular vein itself, is damage to a tributary vessel close to its entry into the main trunk. When this occurs, or when a small puncture is made into the jugular vein itself, some caution is required in applying a ligature. A lateral ligature may suffice to arrest the bleeding while the patient is fully anæsthetised, but there is a considerable risk of the ligature becoming detached by the sudden

the help of a good light the surgeon can see exactly what he is doing. The glands should be removed if possible in one piece, and they should not be lacerated or incised for fear of infecting the surrounding tissues. Needless to say, the removal should be complete and final.

A frequent error is to commence dissecting out the glands before displaying thoroughly the anatomical landmarks and important structures which are to be avoided. Blunt dissection is not to be despised if it is discreetly used; the objection to it is the rough manner in which it is so often carried out. Any handling which involves pulling and tearing may be disastrous, for it may cause rupture of a vessel at a point where it is not easily accessible. Cutting through tissues which are on the stretch also must be done with great caution, because quite large veins may be unnoticeable when they lie in strands of tissue which are being drawn upon.

Lastly, it may be remarked that the surgeon's duty is not always completed when the glands have been removed and the wound has healed. He has to remember that the patient is likely to have tuberculosis in other parts of his frame and especially in his lungs, and the surgeon must not only keep a watch for these complications, but he must in every case instruct the patient to observe the usual methods of precautionary hygiene, or, preferably, must place him under the care of a physician for this purpose. Especial attention must be paid to the pharynx. Any respiratory obstruction caused

by adenoids will need attention; while the advice that is sometimes given, to the effect that no treatment of tuberculous glands in the neck is complete unless the tonsils, whether apparently normal or not, have been dissected out, probably is sound.

portion of the left lateral lobe which necessarily had been left undisturbed.

Therefore, it is judicious and straightforward, when asked to remove the thyroid gland merely because of the deformity it causes, to hesitate, to dissuade, and if the patient is pertinacious and determined, to agree with reluctance.

Exophthalmic Goitre

To operate for Graves's disease often is malpraxis. The operations are attended with risk. Moreover, the disease is one from which the patient is likely to recover sufficiently well without the surgeon's help. (This expression of opinion does not refer to those cases of enlargement of the thyroid with a moderate amount of tachycardia, but without the exophthalmos, tremors, and palpitation which are the accompaniments of genuine Graves's disease. In such cases operation is not entirely contra-indicated by the tachycardia, although a rapid pulse is an additional reason for hesitating to recommend any surgical interference; and the more rapid the pulse by so much the more will caution be required.)

The surgical press is apt to give an incorrect idea of the dangers of operation in this condition. Undoubtedly the risks are greater, at any rate in the hands of a surgeon whose experience and dexterity are of the average standard, than the perusal of some of the published lists of successful cases might lead one to suppose.

SUBSTERNAL GOITRE

Goitres which lie below the level of the top of the sternum, and those also which grow low down in the neck from the isthmus of the gland, and which look as though they might become substernal, ought to be operated on, even if they do not give rise at the time of examination to any pressure symptoms

The reason is that a relatively slight enlargement, from hæmorrhage or other cause, of a substernal goitre may cause severe and even fatal dyspnœa owing to the confined space in which the tumour lies Hæmorrhage into a goitre or into a goitrous cyst is not a very rare event, and more than one instance of sudden death from suffocation has resulted from this cause James Berry [1] mentions the case of a patient who died on the doorstep of a London hospital from dyspnœa due to this complication, and he gives details of another case where an urgent operation alone saved a patient from strangulation owing to a sudden effusion of blood into a substernal goitre Jacobson and Stewart [2] refer to similar cases

A few years ago a man was walking across Regent's Park when he was seen in a moment to clutch hold of the railings beside the path and to struggle for breath He died of suffocation At the post-mortem examination a small substernal goitre was found compressing his trachea There was no atrophy of the cartilaginous rings of the windpipe and no hæmorrhage into the

[1] *Lancet*, Vol II 1907, p 1368

[2] The Operations of Surgery," 1902 Vol I p 524

goitre, and I have little doubt that this case affords an example of a thyroid swelling which had lain in the neck, becoming for some reason suddenly displaced downward behind the sternum.

With regard to those swellings which cause pressure symptoms, they ought to be operated on without undue delay, unless there is some definite contra-indication. Stridor is the outstanding symptom, and usually it is caused by lateral deflection and indentation of the trachea. If unrelieved, the pressure causes absorption of the cartilages of the windpipe, the walls of which become thin and flaccid. And the longer the condition is allowed to remain unrelieved the more will be the damage accruing to the trachea. Moreover, the patient will be running a definite risk throughout of sudden death from suffocation. As mentioned already, an effusion of blood into a thyroid swelling may easily cause fatal dyspnœa, especially if the trachea be flaccid owing to long-continued pressure.

I know of one case in which a substernal goitre gave rise to symptoms which were mistaken for those of asthma. The patient, an elderly gentleman, had been under treatment for some months on account of difficulty in breathing which his doctor attributed to asthma. One day, when staying away from home, his breathing suddenly became very difficult and strangulation was threatened. Skilled advice being sought, an immediate operation was advised. The goitre was removed successfully by Mr. James Berry, and the patient has had no trouble with his breathing since.

A lad of about fifteen years suffered from difficulty of breathing which had come on gradually. Exposure by operation showed what was taken to be an arrested development of the windpipe, the calibre being only sufficient to admit the smallest size of tracheotomy tube. This tracheotomy did not suffice to provide an adequate airway, dyspnœa and cyanosis increased, and after some months the boy died. At the post-mortem examination a "scabbard" trachea was found, the bilateral compression of the tube having been brought about by symmetrical enlargement of the two lobes of the thyroid gland. *What had been regarded as a mal-developed* windpipe was merely the anterior fold of the compressed trachea. The thyroid swellings were not discovered until after death.

Operations for Goitre

Tapping of Thyroid Cysts

Puncture of a thyroid cyst for purposes of either diagnosis or treatment by injection is a dangerous operation owing to the liability of causing hæmorrhage. This complication cannot be avoided by any precaution on the part of the surgeon. On the surface of the thyroid gland is a plexus of large veins, and if the puncturing needle escape these, there is still apt to be copious bleeding into the cyst after the evacuation of some of its colloid contents, and this may cause dyspnœa or diffuse hæmatoma of the neck. James Berry,[1] whose

[1] Burghard's "System of Operative Surgery," 1909, Vol. III. p. 58.

practical knowledge of the surgery of the thyroid gland probably is unrivalled in this country, states that he "has known several cases in which the patient's life has been seriously threatened or even lost by injudicious tapping of a thyroid cyst."

Extirpation

The operation of extirpation of the thyroid gland consists of removal of one lateral lobe and the isthmus, with perhaps a varying amount of the other lateral lobe. The entire gland is not removed; a portion must be left to serve the needs of the organism.

The best incision is a curved one corresponding with, but a little below, the lower outline of the enlarged gland. This incision should be carefully planned, or the surgeon at one or other stage of the operation will find himself in difficulties through not having a clear view for his dissection.

The two common errors are, on the one hand, to make the incision too high up in the neck, in which case it may be difficult to have proper access to the inferior thyroid veins and the retrosternal space—one of the danger zones of the operation; and, on the other, to make the incision too much in a transverse direction, thus not allowing a good exposure of the upper pole of the gland. The incision must curl upward towards its hinder extremity regardless of the fact that the resulting scar will not be quite so easily concealed. The incisions illustrated in surgical textbooks frequently err in one or other of these essential points.

Having divided the skin and superficial fascia with the platysma muscle, these should be dissected away from the deep fascia over the whole area of the gland. The deep fascia and the thinned-out infrahyoid muscles are then divided transversely at the lower level at which they are exposed, and are turned up so that the entire lateral lobe and isthmus of the gland are laid bare. Not until this full exposure has been completed must any attempt be made to separate the gland from the structures to which it is attached—a precaution which is not always observed.

Hyperthyroidism and Tetany

In dealing with the special dangers attendant upon partial extirpation of the thyroid gland, special attention must be given to hyperthyroidism. The rapid pulse and other symptoms of this condition are especially prone to follow operations upon those who have exophthalmic goitre. At the same time it is to be remembered that severe and even fatal hyperthyroidism may occur after operations for simple parenchymatous goitre. Happily there are certain measures which will minimise, even if they do not quite abolish, this unpleasant sequel.

These measures include:

(1) Gentle handling of the gland so as to avoid all laceration and bruising. It has been recommended that crushing of the isthmus or the lateral lobe should be done in order to prevent hæmorrhage when these structures are divided. This is an unnecessary and perhaps

dangerous practice; it is better to cut through these tissues with a sharp knife.

(2) Drainage of the wound after operation by means of an india-rubber tube. This is most important, for it allows the escape of any colloid material which may be subsequently poured out from the cut surface of the piece of gland that has been left behind; and the amount escaping in this way may be surprisingly large. A drainage tube will also allow the escape of effused blood, and this is desirable, for an effusion of blood pressing on a flaccid trachea may cause dangerous and even fatal dyspnœa. Gauze drainage is inefficient and unsafe. It is inefficient because it does not ensure a free exit of fluid; it is unsafe because in withdrawing the gauze it may pull away a ligature and cause hæmorrhage. T. P. Dunhill,[1] in a most instructive paper, calls attention to this danger. He has known of two instances in which removal of a gauze drain on the second day after operation has brought about sudden and great hæmorrhage necessitating immediate opening of the wound in order that the bleeding vessel might be secured.

(3) The administration of copious saline injections by the rectum, under the skin or into a vein.

(4) The use of local anæsthesia in preference to a general anæsthetic. Probably the choice of anæsthesia is not of so much importance as the precautions previously described, but the matter ought to be mentioned as so many writers have stated emphatically that local anæsthesia is much the safer method to employ.

[1] *B. M. J.*, Vol. I. 1909, p. 1225.

Tetany, which again may be of fatal significance, is a rare consequence of partial thyroidectomy, and probably is attributable to the removal of an excessive amount of the gland tissue. I have seen one case in which death ensued within a very few days of the operation. The patient, a girl, had previously had one lobe and the isthmus of an enlarged thyroid gland removed in order to improve her appearance. Subsequently she persuaded an operator to remove the remaining lobe in the interests of symmetry. This he did, with the result already mentioned.

Hæmorrhage

Much of what has been said in dealing with the removal of tuberculous glands from the neck is applicable here to extirpation of the thyroid gland. The surgeon should operate in a good light, he should have a free exposure of every structure which he has to divide, and he should keep the wound dry. It may be as well, for the purpose of emphasis, to repeat the warning as to the danger of lateral ligatures and ligatures applied to a hole caused by cutting through a tributary close to its entry into a large vein. If any of these are used the patient should be allowed to regain his reflexes sufficiently to strain, in order that the holding power of these ligatures may be tested before the wound has been sewn up. In this way also a small vein may be discovered which has escaped ligature, but which will bleed under the effort of straining. Mr. James Berry [1] de-

[1] *Lancet*, Vol. II. 1907, p. 1369.

scribes post-operative venous hæmorrhage as the main danger of a thyroid operation.

During the dissection special attention must be given to the inferior thyroid veins. If one of these be cut inadvertently before being secured it is apt to retract down behind the sternum, from whence it may be exceedingly difficult to retrieve.

Wounds of Nerves

The recurrent laryngeal nerve is the most important nerve which is likely to be injured; and as it passes up in the neck between the branches of the inferior thyroid artery, it is as well if possible to get a clear view of the nerve itself, so as to avoid accidentally nipping it with a pair of pressure forceps or including it in a ligature. In any case it will be well in tying the various branches of the inferior thyroid artery to keep as close as possible to their entry into the thyroid gland.

Wounding of Trachea or Larynx

Accidental perforation of the crico-thyroid membrane has happened, with fatal consequences. A more likely and equally regrettable mishap is perforation of the trachea.[1] Sepsis of the wound and pulmonary complications are possible consequences of these injuries.

In some cases, and especially in those in which the disease is one of long standing, and in which the trachea is softened and distorted, dyspnœa may arise during operation. For its relief an alteration of the posture of

[1] J. Berry, *Lancet*, Vol. II. 1907, p. 1370.

the patient's neck and head is usually sufficient; and, if not, it is almost certain that the breathing will be relieved as soon as the deep fascia has been divided. Should the dyspnœa continue immediate division of the thyroid isthmus is indicated.

As with the removal of tuberculous glands, so also with extirpation of the thyroid, it is necessary to suture the deep fascia and the platysma in order to obtain a good scar; nor must the surgeon forget to sew together the cut ends of the divided sterno-hyoid and sterno-thyroid muscles.

Enucleation

The operation of enucleation is performed sometimes in preference to extirpation on cases in which there is a cyst or encapsuled adenoma in the thyroid gland. Many of the remarks already made in connection with the operation of partial extirpation of the thyroid gland are applicable with equal force to enucleation. The only point of special interest is the necessity of finding the capsule of the adenoma or cyst, and keeping in close contact with this capsule throughout the process of enucleation. If such precaution be observed there will be but little hæmorrhage. Failure to follow the rule will cause much loss of blood and a mangled thyroid gland.

In the case of a cyst which has stretched the overlying thyroid tissue into a thin translucent membrane it is easy to cut through this membrane together with the capsule of the tumour in one cut, and thus to lose touch

with the boundaries of the adenoma or cyst. To avoid this it will be best not to incise directly where the growth comes to the surface, but to cut through the normal gland tissue a little distance away, gradually deepening the incision until the glistening capsule is displayed.

Thyro-glossal Cysts

In removing thyro-glossal cysts care should be taken to dissect out, not only the cyst, but also the prolongation into it, above and below, of the remains of the thyro-glossal duct from which the cyst has its origin. The duct passes upward behind or through the body of the hyoid bone, and a careful and tiresome dissection will be required in order to clear out this portion. Thyroglossal cysts, owing to the difficulty of carrying out such a complete removal of the vestigial duct, have an unpleasant way of recurring after operation.

CHAPTER IV

TRACHEOTOMY

Any medical practitioner may be called upon in sudden emergency to open a patient's trachea in order to save him from asphyxiation. The procedure is easy enough if the operator keeps calm and is not in too great a hurry. Undue haste is the first stumbling-block for the inexperienced. Reliance should be placed on the fact that it takes a considerable time—from ten to twenty minutes—to kill a healthy man by suffocation. Artificial respiration will restore to life individuals who have been submerged under water for this length of time, and the heart will continue to beat for many minutes after a man has been hanged. Therefore the surgeon need not be in such a desperate hurry to open the trachea in cases of laryngeal obstruction. Necessity there is, of course, for speed; but haste is likely to defeat its object. The ragged and breathless effort to save a few seconds more often than not is wasteful and extravagant of time. Calmly and thoughtfully carried out the operation takes but a few seconds, and any attempt to economise time beyond this will be dearly bought, even though the patient's heart be feeble through the attrition of age or the poison of disease. Each cut should be made

efficiently and firmly, and no manipulation should be done which is not purposeful.

I have examined the larynx of a man who died of suffocation. A tracheotomy had been performed in a vain attempt to rescue him. No fewer than seven longitudinal cuts were visible on the cartilages of the larynx and trachea. The surgeon had been in such a hurry that he had made six ineffectual cuts before making one deep enough to open the air passages. His haste clearly had not led to an economy of time.

By observing the following precautions difficulties will be largely avoided. With the patient's face directed forward and the neck extended, the head is steadied strictly in the sagittal plane. An incision of sufficient length is made in the mid-line of the neck. The depressors of the larynx are separated, and the isthmus of the thyroid gland cut through. The trachea being thus exposed, if time permits, all bleeding vessels are secured. The cricoid cartilage is then fixed with a sharp hook which takes its hold on the central point of the lower border of the cartilage. Then, by a single sharp stabbing movement with a scalpel, the cutting edge of which is directed upward, the first two or three rings of the trachea are divided exactly in the middle line. Before removing the blade of the knife or the cricoid hook, tracheal dilators are inserted into the trachea; and as soon as the initial coughing has taken place, the tracheotomy tube is inserted.

Some of the difficulties which may be encountered during the operation may now be discussed, together with a few of the more common mistakes.

The skin incision may be too short, a defect which impedes the operation from start to finish by preventing a good view of the deeper structures, and which may be productive later on of surgical emphysema of the neck owing to air, blown into the neck by the side of the tracheotomy tube during expiration, not finding a ready escape through the external wound. Another disadvantage comes about if the skin incision is not made exactly in the mid-line of the neck. The operation itself may not be impeded at all by this, but it will be found afterwards that the tracheotomy tube does not lie snugly and comfortably in place as it ought to do.

Division of the thyroid isthmus is not, perhaps, an established practice. Nevertheless, there is an important argument in its favour, for if it is left intact, and if for any reason the tracheotomy tube, having been removed, has to be reinserted, its replacement may be prevented by the isthmus which now lies over the aperture. Wilfrid Trotter[1] states that he has known lives sacrificed in this way by leaving the isthmus intact. Even division of an enlarged isthmus without any ligation of the vessels need not be expected to result in excessive hæmorrhage. As a matter of fact, it is better to cut through an enlarged isthmus than to waste time in endeavours to elude the obstacle. A goitre is more likely to cause difficulty by displacing the trachea or by bulging into

[1] *B. M. J.*, Vol. I. 1919, p. 189.

the wound, than by proving a source of dangerous hæmorrhage.

As mentioned above, when time permits all bleeding vessels should be secured before the trachea is opened. But there may be no leisure to carry out this hæmostasis. Nevertheless, the bleeding is mostly of venous origin, and as soon as free respiration can take place the venous engorgement will disappear and the bleeding will almost or entirely cease, gentle pressure with carefully applied strips of gauze being all that is required to obtain a dry wound. Yet, it must be confessed that there are exceptions to this rule, and these exceptional cases are difficult to deal with owing to the fact that blood passes into the tracheotomy tube and causes explosive and sanguinary coughing and interferes with free respiration. In this emergency the tracheotomy tube should be immediately replaced by a rubber tube, so that the inspired air may be unsullied with blood while the bleeding vessels are being sought and secured.

Difficulty in finding the trachea has been recorded, and is most likely to come about in cases of displacement due to goitre, and in infants. In the latter case, the probable explanation is to be found in an incorrect posture of the patient. If the precept given above be observed as to maintaining the head and neck of the patient strictly in the sagittal plane, it will be hardly possible to miss even the small, soft, and flexible trachea of a little child.

Rumour chronicles instances in which tracheotomy tubes have been accidentally inserted into the tissues

of the neck beside the trachea, into the pretracheal space, and even into the œsophagus. I do not know at first hand of any of these mishaps. Probably some are attributable to an inexperienced surgeon losing sight of the tracheal opening after it has been made, or failing to insert the tube into the windpipe because the incision is too small for the insertion of the tube. All difficulty of this kind can be avoided by retaining hold of the cricoid cartilage with the sharp hook and by inserting the tracheal dilators before the knife is removed from the windpipe.

Great care must be taken not to incise the cricoid cartilage, especially in children; for it has been found that in those cases in which the cricoid is cut it may be difficult or even impossible for the patient to resume normal respiration later on, and so the tube cannot be removed as soon as is desirable.

Again may it be reiterated that nearly all the difficulties and accidents attending tracheotomy are due to a want of coolness on the part of the surgeon. He should be calm and deliberate throughout, and must turn an ear of stony deafness towards the irrational comments and exhortations of excited bystanders.

There is one special warning which is necessary in connection with the performance of tracheotomy for sudden obstructive dyspnœa, and it is this, that in all cases in which the cause of the obstruction is not obvious, the pharynx and glottis should be examined first with the finger. Oddly enough, this simple and natural precaution occasionally is omitted, and a tracheotomy is

performed for a blockage which could easily and quickly have been removed through the mouth.

Sometimes tracheotomy is called for when the impediment to breathing is at some level below the larynx, as in certain cases of goitre. In these an ordinary tracheotomy tube is likely to be too short to give relief, and either a special instrument, or a piece of india-rubber tubing which will pass beyond the block, must be used.

In a sudden case of this sort a piece of stethoscope tubing has been the means of saving life. On the other hand, I have known at least one life that has been lost through failure to appreciate this simple reasoning. Other similar cases have been recorded.[1]

With regard to tracheotomy tubes one or two elementary remarks may be made. The instrument should be flexible, or at least the shield must be attached in such a way that its movements are not transmitted to the tube. Rigidity of the tube and shield are apt to permit of injury to the interior of the trachea, and rigid tubes are still to be found in certain hospitals. To prevent the tube from being ejected when the patient coughs, or from being pulled out by a frightened or fractious patient, it should be secured by tapes fastened to the flanges and tied behind the neck. Sometimes the breathing becomes obstructed by membrane—supposing the case to be one of diphtheria—and therefore the patient should not be left without skilled attendance.

[1] Jacobson and Stewart, "The Operations of Surgery," Vol. I. p. 525, 1902.

Removal of the inner tube must be effected at once, and if this fails to remove the blockage, the tapes should be cut and the outer tube removed as well. A tracheal dilator, therefore, must always be ready at hand, both to keep patent the wound in the windpipe while the tube is out, and to facilitate its replacement.

A common and sometimes serious cause of trouble after the operation is to retain the tube for too long a period. The resumption of normal breathing in these circumstances is apt to be rendered difficult, and a good deal of worry and concern may be experienced before the patient can be enabled to dispense with the instrument. In every case in which the necessity for a tracheotomy is merely transient, endeavours should be made to remove the tube within forty-eight hours from the time of its insertion, or at the earliest moment possible after this interval.

Some interesting facts, in connection with threatened suffocation during general anæsthesia for which tracheotomy may be required, are mentioned later, in the section on General Anæsthesia.

CHAPTER V

EPITHELIOMA OF THE TONGUE

ONLY the straightforward type of case will be discussed here, that is to say, an epithelioma limited to the free portion of the tongue. The usual operation for this condition consists of excision of the affected portion and a fair amount of apparently healthy tissue around it, together with a comprehensive removal of the lymphatic glands in the sublingual and submaxillary regions.

The problem at once arises as to whether the extirpation of the tongue and the glands should be done at the same operation or on separate occasions. The decision of this point will depend entirely upon the surgeon's individual judgment, who will have to consider his own skill and celerity of work, the extent of the disease, the magnitude of the excavations required for its eradication, and the patient's fortitude and power of endurance. If he purposes to complete the operation at one sitting it will be best to commence with the dissection of the glands, because this is the clean part of the operation, and moreover has the advantage of rendering the excision of the tongue relatively bloodless owing to previous ligation of the lingual arteries in the

entrance through the divided Wharton's duct—and for this reason Butlin [1] used to recommend that the wound in the neck always should be drained.

The chief cause of mortality resulting from operations upon the tongue for malignant disease is pneumonia. And for this there are two main causes, both of which are largely preventable. The first is the inhalation of blood into the air passages during the operation. The Trendelenburg position has been recommended as a means of avoiding this danger; but there are better ways. The first, and the one that should be adopted in all cases where the tongue has to be separated far back, is a preliminary tracheotomy—preferably performed under local anæsthesia a couple of days before the main operation—accompanied by plugging of the pharynx with gauze as soon as the patient is fully anæsthetised and before any cutting whatever is done within the mouth.

The second method, which is available for cases in which the stump of the tongue has not to be severed, is that suggested by Crile. As soon as the patient is fully anæsthetised a rubber tube is passed along each nostril until it reaches a point just above the glottis. The pharynx is then plugged with gauze. These tubes must be of as large a calibre as possible in order to allow of free and unimpeded respiration.

The intratracheal administration of ether accompanied by plugging the pharynx with gauze is a third means of attaining the same object.

[1] "Operative Surgery of Malignant Disease."

The other main cause of pneumonia following these operations is thought to be the entry of foreign material into the air passages during the patient's efforts at deglutition. For the first days after the operation, therefore, he should always be fed by means of a nasal tube.

CHAPTER VI

SWELLINGS OF THE SALIVARY GLANDS

Mixed parotid tumours are not rare, and it will fall to the lot of most medical practitioners to give advice upon the treatment of these growths. The doctor, unless he is aware of the natural history of these swellings, is apt to make a false step—I refer to cases in which facial paralysis and other symptoms of malignancy are absent—by telling the patient that the lump is quite harmless. This information will certainly please the patient, but it may lead him to defer operation, to his great detriment later on. For these small encapsuled tumours are easy enough to remove in the early stages, especially so as they commonly originate or are situated in the superficial portions of the gland. With the lapse of time, however, the adenoma not only becomes larger, but it spreads into the deeper portions of the gland which are relatively inaccessible to the surgeon. More serious even than this is the fact that these mixed salivary tumours have a definite tendency to become malignant. Recurrence after removal occurs in nearly half the number of cases submitted to operation,[1] whilst twenty-five out of every hundred cases eventually

[1] Wood, ' Annals of Surgery," 1904, p 212

become definitely malignant. Therefore the practitioner should be earnest in persuading any sufferer to have the adenoma removed at the earliest date, and should reserve his reassurances until the operation has been completed.

The best incision for removal of a mixed parotid tumour is one which is parallel with the zygoma, or, if the adenoma be large, a T-shaped one. The *facial nerves* lie deeply, and will not be injured unless the surgeon allows the point of his knife to wander far from the capsule of the tumour. But division of the *parotid duct*, if its anatomy be not borne in mind, is a likely accident, and it is a mishap not always easy to remedy, because the point of division as a rule is behind the anterior border of the masseter muscle, in which event Deguise's operation by elastic ligature is not available, while it is often difficult to discover and ligate the duct, and so to put the gland out of action as a secretory organ.

I had to treat a case in which a large salivary cyst developed in a patient's cheek after an operation for removal of a parotid tumour. The scar of the original incision was vertical, and the surgeon who had done the operation told me that he had never thought about the parotid duct while he was performing the enucleation. I cut down with the intention of using Deguise's method if the division of the duct was sufficiently far forward, or to tie the duct if the division was found to be behind the anterior border of the masseter muscle, on the ground that a gland will cease to secrete if its duct be obliterated.

By passing a fine probe through the papillary opening in the mouth I was able to find the distal end of the duct and to ascertain that it had been divided far back. But I could not find the proximal end, and therefore both of my purposes were frustrated. The cyst, however, overlapped the distal portion of the duct, so I passed a ligature from the mouth into the anterior portion of the cyst and out again through the mouth in front of the masseter and tied it tightly, trusting to pressure necrosis to establish a new opening into the mouth. A firm pad was applied to the cheek after the wound had been closed. The measure succeeded admirably, and the cyst disappeared. But whether the cure was a permanent one or not I cannot say. I have always been afraid that these artificial and remedial salivary fistulæ might cicatrise with time.

The oozing of salivary secretion which frequently is seen to follow incisions into the substance of the parotid gland usually ceases spontaneously or with pressure gently maintained. I have never seen a lasting salivary fistula from this cause.

Secondary Parotitis may appear as a complication of other illnesses. Especially used it to be associated with abdominal disorders. The fundamental condition which permits of this form of parotitis is arrest of the salivary secretion. As in other regions ot the body so it is here, an arrested outflow from a secretory organ is favourable to infection. In the case of the parotid gland the potent causes of arrest of the outflow of saliva are: (1) organic blockage of the duct, which may be due to a calculus;

and (2) the lack of the normal stimulus which accompanies the chewing of food. It is the latter factor that is the essential one in the production of secondary parotitis; and in most instances of the condition it will be found that a subsidiary factor also has been present, namely, the administration of morphia, and perhaps of atropine. And in any condition in which we have a total absence of chewing together with the repeated exhibition of morphia, we must be on the look-out for suppurative parotitis, no matter what condition it may be that leads to the coincidence of these two causes.

The chief points that concern the surgeon are that the parotitis is an infective condition and that it should be treated at once by incision. If operation be delayed because no fluctuation can be felt or for other reason, there is great danger of an extension of the sepsis to quarters which are beyond the surgeon's reach. For example, a thrombosis of the pterygoid veins may come about and may extend to the cavernous sinus: a danger which sounds, perhaps, more hypothetical and anatomical than real; nevertheless, I have seen it happen with a fatal issue.

Swellings of the submaxillary salivary gland are sometimes difficult to differentiate from enlargements of the lymphatic glands in the same neighbourhood. The history of a swelling appearing rapidly in the submaxillary region during a meal may in itself enable a correct diagnosis to be made. But there is one step which should be taken in every doubtful case, and this

is to examine the orifice of the duct beneath the tongue. Not only may we find that a foreign body—the bristle of a tooth-brush, for example—has entered the duct from the mouth or that a salivary calculus is lodged in the duct; but even in the absence of such gross and tangible evidences, we may note some redness, swelling, and unnatural turgidity of the orificial papilla or some tiny petechiæ upon it; and these abnormalities strongly suggest the presence of a lesion of the salivary gland itself. The effects of inflammatory or obstructive conditions of the salivary glands frequently are projected in this way in the mucous membrane around the opening of the ducts.

Now and then a case is met with in which an abscess has formed in the submaxillary gland owing to the presence therein of a calculus. There is a risk that the presence of the calculus may remain unsuspected, the abscess being attributed to infection of the lymphatic glands and being treated by simple incision and drainage; the result being a chronic sinus that will not heal until the calculus has been found and removed by a subsequent operation. In these cases of salivary calculus, if careful inquiry be made, a history of submaxillary pain and swelling, accentuated at meal times, probably will be forthcoming and will put the surgeon on to the correct scent.

A common sequel to operations on the submaxillary gland is paralysis of the depressor labii inferioris. The course of the nerve supply to this muscle is discussed elsewhere (p. 17).

Before quitting the subject of swellings of the submaxillary glands it will be well to refer to two causes which may fail to receive immediate recognition. The first is the administration of Potassium Iodide. Owing to individual idiosyncrasy, this drug in some patients produces symmetrical swelling of the submaxillary and sublingual salivary glands. The second is mumps; in this disease it may happen that unilateral or bilateral enlargement of the submaxillary or sublingual glands may precede by some days the parotid swellings; moreover, even when the parotid is primarily affected, the swelling may remain unilateral. The practitioner who does not realise these facts may run the chance of being blamed for not taking proper safeguards against the spread of an infectious disease.

CHAPTER VII

TONSILS AND ADENOIDS

WHATEVER view may be taken as to the uses of the tonsils, it cannot be supposed that Nature gave them to us by haphazard. She placed them in our throats for a definite purpose. And it is for us to be able to give good reasons for taking them out whenever we hold such an intention. This merely by the way, and to hint at the possibility that our energies may not always be wisely exercised.

To remove the tonsils is, in most cases, an easy operation. I suppose this is why the operation is so often badly done. The frequency of its performance and the numerousness of the performers no doubt are accountable for the great number of incidental accidents attaching to the operation. I refer to such mishaps as allowing the patient to slip off the end of the table and fracture his skull on the theatre floor. This has happened, and so have many other mischances which only illustrate in a general way that men are fallible, surgeons sometimes clumsy, and anæsthetists not invariably perfect masters of their art.

Of more profit is it to consider errors of a specific

character. Perhaps the commonest of these is to remove too little of the tonsilar tissue, to shave off the projecting portion alone, with the consequence that crypts remain to earn future trouble by offering refuge to septic material. And, if previous unsuccessful attempts have been made in this way, the remains of the tonsils are not so easy to remove cleanly and completely. The essential steps of the guillotine operation are to insert the end of the guillotine well in behind and below the tonsil, which is then pushed through the fenestrum by pressure with the finger or thumb upon the anterior pillar of the fauces, and is so removed by closure of the blade. It is not rare after tonsilectomy by this method to find that a shaving has been taken also from the anterior pillar of the fauces or even from the tongue. This is due to the use of a guillotine whose fenestrum either is unduly large or is of the wrong shape. The aperture should be only just large enough to allow the tonsil to be pushed through, and it should be oval in shape. The circular fenestrum occasionally seen in these instruments is undesirable.

Hæmorrhage after the operation seldom gives trouble; sometimes, however, it continues in spite of ordinary hæmostatic measures. In these cases, with the patient propped up in a sitting position, gentle but firm pressure by means of a small dry swab held in forceps should be maintained upon the bleeding surface without relaxation for a period of six minutes by the watch. If this fails the bleeding may be controlled by suturing together the anterior and posterior pillars

of the fauces over a plug of gauze. I have heard of an instance in which the internal carotid artery was wounded with a fatal result. In this case the tonsil-otome had been incompletely put together, with the result that when the blade was pushed home it projected for some distance beyond the guard.

Before performing tonsilectomy on children it is wise to examine the urine for diacetic acid and albumen. I was asked by a fellow-practitioner to remove the tonsils of a child, which I did suspecting no evil. Next day the patient's urine contained blood and casts—in fact, she had nephritis—and a week later she began to peel. It then transpired that she had recently suffered from a severe "sore throat" while away from home. Chloroform and ether are irritants to the renal epithelium, and for this reason presumably are baneful to people who have nephritis.

Operations for the removal of tonsils and adenoids are often performed upon children at an age when the teeth of the first dentition are apt to be loose and easily knocked out, and care should be used to avoid doing this with the gag. Fond parents are inclined to draw adverse inferences concerning the operator's gentleness when this happens, and I have heard disparaging remarks made of a surgeon on this ground.

In the removal of adenoids, unless a sharp curette be used, tags of partially separated adenoid tissue may be left hanging to the naso-pharynx, which cause inconvenience to the patient both by their presence and by their subsequent necrosis. The trouble is more likely

to arise in the older children whose adenoids have become tough and fibrous. On one occasion I operated on a boy for adenoids in a nursing home, and went my way. An hour later I received a most urgent message to go to the nursing home immediately as the boy was being suffocated. I found him sitting up, in a state of acute anxiety and breathing with difficulty. A tag of adenoid tissue was hanging from the posterior wall of his pharynx, and *with every inspiration was drawn into or against* his glottis, causing a loud, crowing, inspiratory stridor. The tag was easily seized and removed, with immediate relief to every one concerned.

When a curette has been sharpened a great many times, the blade will have become very thin, and in such an event it may break. A friend of mine tells me that this accident happened once while he was operating. The blade of the curette broke off and was not found again. Not only does such a mishap prevent the operation from being completed, unless a second curette is available, but it is disquieting to lose the sharp blade of a curette inside a patient.

A degree of anæsthesia deep enough to abolish the reflexes is a certain danger, and I have seen a patient remain cyanosed for some minutes after operation owing to blood having been drawn into the lungs from this cause. Probably the bronchitis and broncho-pneumonia which sometimes follow operation for the removal of tonsils and adenoids owe their origin partly or wholly to this inspiration of blood and tonsilar tissue.

I have often wondered whether tragedies have

case in which a large pleural effusion has led to sudden death it has been when the patient has sat up in bed.

The moral is clear. The patient should not be moved about in bed or transported to hospital unless and until a sufficiency of fluid has been removed from his chest; and even after this has been done, if his posture has to be changed the movements should be carried out slowly and with deliberation. An eye must be given to the nurse. So common is the custom of sitting a patient up during auscultation and percussion of his chest that the nurse may assist him to assume this position before the doctor has time to call a halt.

I have seen a pleural effusion missed through the use of a blunt needle which failed to penetrate the parietal pleura, this being merely pushed inward in front of the needle. At least this seems to have been the correct explanation; for puncture with a sharp needle at once revealed fluid which was present in large quantity.

On one occasion a man very ill with pneumonia was thought to have an empyema. I explored his chest with a needle, which caused immediate and rather profuse hæmoptysis, followed within a few minutes by the death of the patient. At the post-mortem examination it was seen that the needle had penetrated a short distance only into the solid lung, and certainly had not wounded a large vessel of any sort. Probably the hæmoptysis with its added dyspnœa was the last straw to a patient who was already desperately ill.

Conclusive as the evidence may seem when fluid is withdrawn from the left chest by a needle, I have known a case of pericardial effusion mistaken for an effusion into the left pleura. The needle clearly had drawn the fluid from a distended pericardium and not from the pleural cavity.

A reputed sequel of aspirating a chest is acute pulmonary œdema. To avoid this dangerous complication the fluid should be removed slowly, with not too great a negative pressure in the aspirator, and a portion only of the fluid should be drawn off; or if it is purposed to empty the pleura of exudate entirely, replacement with air or other gas should be employed.

Sears [1] reports a curious kind of misadventure during the aspiration of fluid. He says that six cases have been recorded "in which the aspirating pump was accidentally reversed and air blown into the chest." Five of these patients recovered, and one—a child—immediately died.

Empyema

Diagnosis.—When a needle is used to verify the presence of an empyema or to locate the pus, it is essential that it should have a reasonably large calibre. Otherwise it may be impermeable to pus. Over and over again have empyemata been overlooked through neglect of this physical fact. This is the principal error in exploring for empyema with a needle. But the difficulty of diagnosis is not always to be surmounted by the use

[1] *Loc. cit.*

of a large-bored needle. In the case of an elderly man with symptoms of an intrapleural abscess, repeated explorations with various suitable needles were unproductive of the expected pus. However, in view of the suggestive signs and symptoms, a portion of rib was removed and a copious empyema was discovered, but the bottom of the cavity was filled with large masses of clot, and no doubt it was the presence of this clot that prevented exploratory puncture from achieving its aim.

Berry[1] mentions the possibility of mistaking a liver abscess for an empyema when pus is withdrawn by a needle inserted into the lower part of the thorax; while the danger of causing an hepatic abscess by thrusting the needle through an infected pleural cavity into the liver is referred to by H. D. Rolleston,[2] who gives the detailed account of a case in which this happened.

It is said that the heart and great vessels have been injured by exploring needles, but I cannot verify the statement.

Before quitting the consideration of the diagnosis of empyema, reference must be made to three sins of omission for which surgeons often are responsible. The first of these is to neglect the valuable information which may be derived from X-ray examinations in cases in which the diagnosis is difficult and in doubt. The second is to fail to secure the co-operation of a

[1] *Clinical Journal*, 1905, p 33
[2] *B. M. J*, Vol. II. 1913, p 847

bacteriologist with a view to learning the nature and identity of the infecting organism—a matter which may be of vital importance in determining the method of treatment to be adopted. The third is to omit to examine the chest in supposed cases of acute abdominal disease. This perhaps is the worst fault of all. More than once have I seen post-mortem investigations which have revealed the presence of large and unsuspected empyemas in patients who had died after futile exploratory laparotomies.

Treatment.—Sudden death may occur with large empyemas just as it may with simple effusions, and for the same reason; and similar measures of precaution are required. Thus before transporting to hospital or to a nursing home a patient with a large infected effusion in his chest, a considerable amount of the fluid should be withdrawn, for which reason, and to avoid the pain of two stabs, the needle of the exploring syringe ought also to fit the nozzle of the aspirator.

Operation.—The customary treatment for infected pleural effusions is drainage by means of a tube inserted through an aperture in the chest wall. The time has arrived, however, when we must discriminate carefully between those cases for which this method is suitable, and those for which it is not. Briefly, it may be said that with localised empyemas, and especially those containing thick pus, treatment by drainage is satisfactory. In these, extensive collapse of the lung and wide spreading of the infection do not occur.

In acute, generalised empyema, however, open

drainage as usually performed is nearly always disastrous If the patient does not die early from shock and toxæmia, he merely survives with a collapsed lung and a chronic suppurating cavity in his chest, the walls of which are too rigid to permit of its natural closure and obliteration Especially fatal are the acute streptococcal empyemas which are treated in this way. Frequent aspiration, or air-tight siphonage, with the repeated subcutaneous injection of large quantities of anti-streptococcal serum seems, at present, in these to promise better results in the early stages; though it does not follow that in the near future we shall be unable to counteract those vicious factors which render the open drainage of generalised empyemas at an early stage such an unprosperous remedy as it is to-day

Let us consider those particular factors which so far have got the better of our surgical aims We have to deal with a collection of fluid in a cavity the outer boundary of which is the chest wall and may be regarded as rigid and non-collapsible The inner wall is the lung itself, always tending by its inherent elasticity to pull away from the boundaries of the thorax and to increase the size of the cavity Now it is perfectly true that in a healthy chest the atmospheric pressure is sufficient to maintain contact between the two layers of the pleura as a whole and to prevent immediate and complete collapse of the lung if the thorax be opened Nevertheless, even in health some separation of the visceral from the parietal pleura will occur if the chest be patent And in the case of a large inflammatory

effusion the layers of the pleura are separated already over a wide area, and even where they are in contact beyond the limits of the effusion they are inflamed and abnormal. With these altered statics there is no longer a sufficient countervailing force to overcome the contractile power of the lung.

The foregoing considerations—there are other factors, of course, including the absorption of air from a lung which is at rest—help to explain not only the progressive collapse of the lung in the presence of a large empyema, but the undeniable fact that fluid will not completely drain away through a hole in the chest wall unless one of the following conditions be fulfilled: (1) the fluid is withdrawn by aspiration or siphonage with a pull sufficient to overcome the contractile tension of the lung; (2) the intrapulmonary pressure be raised above that of the resiliency of the lung; (3) the fluid be replaced by air or some other substance. These factors will be considered in detail.

(1) *Aspiration and Siphonage.*—The disadvantages of aspiration are that it has to be repeated, while the canula used is relatively small, and therefore may readily become blocked by small masses of coagulum. A quick, easy, and sometimes handy method of achieving air-tight siphonage with a sufficiently large tube is by means of Patrick Manson's apparatus for draining abscesses of the liver.

(2) In the healthy individual the intrapulmonary pressure is much diminished during inspiration, but the degree of negative pressure produced will vary largely

Unfortunately, the surgeon is encouraged to err in this choice of a site for his incision both by the text-books and by contributors to the medical journals. He is told that the opening should be 'at the most dependent spot available,' so that drainage may be free, and even the tenth rib has been recommended frequently as a suitable one for resection. How this advice comes to be given I am perplexed to know, because the surgeon who persistently follows it will assuredly meet with disaster.

The lower limits I have given above must be observed. If, for example, the surgeon resect a portion of the ninth rib in the posterior axillary line, as likely as not he will expose the liver or spleen. The reason is simple enough. The lung does not extend down to the ninth rib in the posterior axillary line; at this level the parietal and diaphragmatic pleural membranes are in contact, and being in contact they quickly adhere together when an inflammatory process is at work. Consequently, the surgeon pierces the two layers of pleura without finding the cavity he expects, and proceeding onward he pierces the diaphragm too. And the diaphragm is a thinner structure in this situation than some people imagine. Judging from the number of men who tell me that they have committed it themselves or have seen it done by others, I believe this blunder is enacted dozens of times every year. I have been present at two post-mortem examinations in which death was due to general peritonitis brought about in this way, and I have known other examples which have

not ended fatally. As confession is good for the soul, I must admit having been one of the sinners.

Even if the surgeon does open the empyema without perforating the diaphragm at these low levels, he is apt to defeat his own object of securing good drainage, for the diaphragm coming into contact with the chest wall above the opening dams up the pus at a higher level. More than once I have been called upon for such a reason to remove a piece of another rib higher up in order to secure the free drainage which a former operation had failed to provide.

And as the opening in the chest may be made too low so it may be made too high up. With the patient lying on the sound side, and the opposite arm hanging over the edge of the table or supported by an arm-rest, the scapula is rotated and displaced laterally, exposing an area on the chest wall which normally it overlaps when the patient reclines in bed. Now, this temporarily exposed portion of the chest wall is not much covered by muscle and it offers a tempting bait to the surgeon. If, however, he makes his drainage hole here, the scapula when it resumes its normal position will interfere with the opening, and a good deal of discomfort too will be caused to the patient, for he will suffer pain whenever he tries to let his arm lie in the position of rest.

The posterior limits of safety for draining an empyema will depend upon the method which is to be used. If siphon drainage, effected by Manson's liver abscess apparatus, be employed a spot must be chosen where the ribs are sufficiently separated to allow the passage of

the trocar, and this spot will lie in front of rather than behind the posterior axillary line, though chests vary somewhat in the requisite characteristics.

If simple incision be employed in place of resecting a portion of rib the matter of selecting a site becomes one of great importance. On no account must this incision be made further back than the angle of the scapula. The reason for this rule is the presence of the collateral intercostal artery which arises from the main intercostal near the angle of the rib and running downwards and forwards traverses the intercostal space obliquely. The vessel is of considerable size, and is apt to be wounded by an intercostal incision which has been placed injudiciously—that is to say, too far back. And if divided in this way, not only is the vessel difficult to secure, but its injury may be overlooked owing to the hæmorrhage taking place entirely into the pleural cavity. James Berry[1] records that he has seen such a case of intra-pleural hæmorrhage from a simple small incision through the intercostal space, the surgeon not recognising, until the patient was in the post-mortem room, the harm that had been done.

For other reasons than this one the attempt to drain an empyema by simple incision is to be deprecated. The drainage often is ineffectual owing to the limitations of space; while it is quite easy to resect a portion of rib under local anæsthesia, without moving the patient from his bed, if the exigencies of the case render his carriage to the operation theatre undesirable. For I assume

[1] *Clinical Journal*, 1905, p. 33.

that no one would advocate the treatment by intercostal incision on other grounds than that the patient was too ill to undergo resection.

If a piece of rib is to be removed, the incision can be made as far back as the costal angle. I think injury to the intercostal vessels is more likely to come about in this situation than if the site of operation be more anterior; but in any case the complication should not be difficult to deal with, nor is it likely to come about if care be exercised when separating the periosteum from the rib.

cosmetic result is far from satisfactory; in the second place, the nipple is unlikely to be quite healthy in this kind of case.

A young woman of thirty-four years suffered severely from chronic cystic mastitis, on which account her left breast was removed, the nipple being retained. Fourteen months later she returned with a lump situated just beneath this nipple. A second operation was *performed, the nipple and the subjacent tumour* being excised and submitted to a pathologist. The following is his report: "This tumour is an adenoma. There is some increase of fibrous tissue and many of the smaller ducts are dilated and cyst-like. There is no appearance of malignancy."

Clearly in this case the tissue left behind at the first operation was dangerous inasmuch as it was of a character which we have learned to regard as a forerunner of carcinoma.

SECTION III. ABDOMEN

CHAPTER X

THE DIAGNOSIS IN ACUTE ABDOMINAL DISEASE

So broad is the subject of diagnosis in abdominal disease that a single chapter is too small for its full discussion. But no more prolific source of grave errors exists in the domain of surgery, and therefore a few comments on the matter will not be out of place, even if they do not cover the whole ground.

At the outset one may affirm that most errors are due to one or other of two causes, namely, excessive delay and excessive haste. Correct timing is essential to success in acute abdominal disease as in so many other affairs. Provided that he has rallied from the state of primary shock, the sooner a patient is operated upon after the development of a sudden lesion causing peritonitis, intra-abdominal hæmorrhage, or intestinal obstruction, the greater will be his chance of recovery. This theme has been thumped upon everlastingly by the surgeons, and to-day is freely understood and accepted. Nevertheless, dangerous, fatal, and avoidable delays have not been abolished altogether even now. One still sees cases of acute abdominal disorder which have a fatal issue because the surgeon has been invoked

too late. For this melancholy wait-and-see practice the use of opiates is largely responsible. *The doctor* is tired, and it is such a business sending the patient off to a hospital or a nursing home at once, it wants such courage and is so upsetting to the family; besides, he is not sure that the patient really has a serious abdominal lesion; on the whole, he thinks he will just give the patient a little something to quieten him for the night and will see him again in the morning.

One can appreciate perfectly the difficulties of the general practitioner in a doubtful case of this kind; and however severely we may criticise him in the light of after events, and however strongly we may disapprove of his management of the case, it is well to remember that his task has been hard while criticism is very easy.

Hospital surgeons and resident medical officers always should make things comfortable for the doctor who happens to send a case to hospital as one of acute abdominal disease, which proves to be in no need at all of an operation. Such misadventures are bound to occur if all cases presenting suspicious abdominal symptons are sent to hospital in an early stage and in a favourable condition, and the doctor who first handles these cases should feel confident of the loyal support and *co-operation of the hospital staff.*

But while the general practitioner often is guilty of unnecessary delay, the surgeon frequently fails through excessive haste. When a surgeon is summoned to see an urgent abdominal case, too often is he content to forego

a thorough examination of the patient. He is obsessed by the abdominal symptoms, with the consequence that he is apt to make grave mistakes in diagnosis.

Symptoms due to lead colic, uræmia, locomotor ataxia, cerebral abscess, acidosis, severe anæmia, have been wrongly attributed to abdominal disease, and the sufferers have been subjected to laparotomy. Caries of the spine, tumours of the spine and spinal cord, aneurism of the aorta, have led to similar errors, and so too have affections of the kidney and genito-urinary tract. Even more commonly than these conditions are lesions of the thoracic viscera mistaken for abdominal disease. Pneumonia, pleurisy, empyema, pneumothorax, pericarditis and certain other cardiac disorders each may cause pain in the abdomen accompanied by pyrexia, obvious illness and distress, rigidity of the abdomen and vomiting. The energetic surgeon, in the face of evidence such as this, is prone to act decisively and without that amount of hesitation and caution which are required; and not infrequently he fails to make a correct diagnosis even through the laparotomy wound. Probably we all have seen and have personal experience of discomfiture in the post-mortem room from this source. Failure to examine the patient thoroughly is the cause of the mischief.

We should remember that the lower portion of the chest wall cannot be fixed unless the abdominal muscles are rigid. We should remember that pain may be referred to the abdomen when the seat of disease is elsewhere. We should remember that vomiting is a protean symptom

which, from whatever cause arising, itself may produce pain and tenderness of the abdomen. And, in fact, we should not focus our attention on the supposed abdominal symptoms alone. The entire patient should be included in our survey and subjected to a careful and general scrutiny.

These mistakes of diagnosis have been attributed to undue haste. They have other contributory sources. Careless clinical habits and bias are two of these. We are biased by the strong presumptive evidence of abdominal disorder, and therefore we fail to carry out a complete investigation of the case. We omit to examine the patient's urine, his chest, his spine, his nervous system; we dismiss with insufficient thought his history of recent severe headaches, of fainting attacks, and other apparently unconnected complaints. We neglect these things and we stumble.

Another mistake is to expect too much information from individual symptoms. Single features in a landscape, as a rule, are not sufficient guides to the traveller. Nor in disease are single features sufficient guides to the surgeon. A common error, this, to expect too much information from one particular sign. One says that loss of liver dullness is a proof that a perforating lesion of the bowel is present. Another says he has learned by painful experience to place no reliance whatever upon the sign. They both are wrong. For the loss of liver dullness may be an indicator of great value to the diagnostician, but only if considered together with other conditioning circumstances. To make a correct

diagnosis we must study the *tout ensemble;* we must look at the case as a whole, glancing here and there, examining individual points closely and exactly; but our recognition of the case, as in the recognition of the face and figure of an old acquaintance, in the main will depend upon the psychical blending of a number of characters which have been observed, knowingly or unknowingly, and stored away among our subconscious memories. We cannot recall exactly these individual characters, one by one. We cannot portray them, perhaps, from mere memory. Shown this eye, or that forehead, we cannot name its possessor, be he or she our daily comrade or cherished friend. But the face we know. That we could surely recognise across the gulf of many years. The dimly figured features which singly cannot stir even the dust of our memories, when blended will form a whole which we can identify without the taint of any doubt.

His skill to envisage truth amid complexity is that which marks the artist from the artisan. So the high art of clinical diagnosis lies rather in the intuitive and comprehensive blending of evidence than in anything else. We must, of course, expose and collect all the available evidence before we can blend it. And in this process special care is required lest some of the chief features of the case be omitted from the picture.

Some profit may be derived from a consideration of the leading symptoms of acute abdominal disorders with special reference to certain fallacies connected therewith.

Emesis

Vomiting is such a frequent accompaniment of illness ' whatever cause, that its mere occurrence is not of self sufficient to suggest the presence of abdominal sease. But when we are told that a patient has been omiting there are certain precautions which we should ike. We should ask to see the vomited material, and iould not be content without such inspection, from hich we can learn its amount and to some degree its ature. We should inquire also into the exact times ' the vomiting. It may be that the patient is sick ıly during or immediately after a meal, or when he is one; and these points may have some significance.

Once I was asked to see a lady with a view to erforming a gastroenterostomy upon her. For some me past she had been suffering from recurrent attacks f vomiting, and these attacks had latterly been getting iore frequent and more severe. She was deaf, she had ot been wasting. A curious feature of the bouts of ckness was the intense vertigo with tinnitus which ccompanied them. The case was one of Ménière's isease.

Patients sometimes will cause themselves to vomit, ı order to create anxiety or to gain sympathy and ttention from those about them.

A lady complained that she had been vomiting lood, and named an eminent physician who, she said, ad advised her to undergo an operation on the stomach. 'here was reason, subsequently, to doubt her veracity

on this point. At any rate, she was placed in a nursing home where two things were noticed. In the first place, the vomit was merely tinged with blood, which did not look as if it had come from the stomach. Secondly, she did not vomit except when she was alone. Events proved that emesis in this case was induced by the patient's own endeavours, and that it was not directly due to any lesion of the stomach or other abdominal organs.

By inspection of the vomit valuable information may be gained as to the cause of the sickness. In acute peritonitis the vomiting is frequent, and the material ejected, after the first few attempts, is bile-stained and continues so, but does not become stercoraceous—unless in the terminal phase. With obstruction, on the other hand, the vomit soon becomes stercoraceous, except in those cases where the obstruction is high up. Moreover, in cases of obstruction as a rule the vomiting is more copious than in cases of peritonitis. These points are not without importance, and their value is lost unless the rejected stomach contents are kept for the surgeon's inspection.

Pain

The outstanding symptom of acute abdominal disease commonly is pain. Nevertheless, pain is to be regarded as indicating disorder within the abdomen only when it is accompanied by certain other symptoms. Considered by itself, as an isolated fact, it has hardly any diagnostic significance at all. As mentioned already, pain

in the abdomen may be due to extra-peritoneal disease. Furthermore, in some cases of peritonitis there may be little or no pain. Probably most of us, at one time or another, have made false steps through attributing too much diagnostic value to stomach-ache and vomiting, while paying too little attention to the remaining features of a case. This is why we sometimes perform laparotomy for the cure of symptoms which are really due to locomotor ataxia, lead colic, empyema, or pericarditis. We fail to observe the case as a whole, our minds being held in thrall by certain individual signs upon which we wrongly think we can rely. One more caution is required, and this is to discover the nature of the pain. "Where did the pain begin?" "Where is it worst now?" "Does it come and go?" "Have you had a similar pain before?" "Has the onset of pain any relationship with the taking of food?"

A patient consulted an abdominal surgeon on account of severe indigestion. Asked when the pain came on he replied that going upstairs was especially apt to bring it about. He had aortic disease with angina pectoris.

Tenderness

Tenderness of the abdomen often is of more help than pain to the diagnostician, especially in the localisation of a lesion. We need, of course, to distinguish tenderness due to subjacent inflammation from that due to psychical causes; which may be done in part by comparing the evidence of tenderness obtained when

the patient's mind is not distracted, with that elicited when he is engaged in conversation and therefore off his guard. Frequently, and especially in women, we have to accept the patient's statements at a large discount. One source of fallacy often crops up; this is the fact that the mere act of vomiting will cause abdominal tenderness, usually greatest in the epigastrium.

So far, in discussing abdominal tenderness, deep, soft pressure with the warm hand has been intended, as distinct from the superficial tenderness due to hyperæsthesia of the skin.

Rigidity

On this subject a few points only call for remark. The first is the necessity for using warm hands to palpate the abdomen. The tonicity of the abdominal muscles cannot be tested properly with cold hands. Secondly, attention is called to the value of ascertaining the area of maximum rigidity, for this may provide useful localising evidence. Some individuals, mostly hard, muscular men, *seem unable to relax their abdominal muscles in* health. By flexing the knees and pelvis, supporting the shoulders and instructing the patient to sigh, difficulty from this cause may be overcome to some extent.

Lastly, it should not be forgotten that rigidity of the abdomen may be evidence of a thoracic lesion, being part of a reflex endeavour to fix the lower margin of the chest wall. This fact is so easily overlooked that it requires special emphasis.

Constipation

Retardation of peristalsis is a usual accompaniment of acute abdominal disease, and is no doubt a part of nature's effort to secure rest for the affected structures. This association, however, is not invariable. An acute appendicitis, for example, may take place during an attack of diarrhœa. Therefore the absence of constipation should not mislead us into thinking, without further investigation, that no grave inflammatory lesion is present within the abdomen.

Constipation has its own dangers in acute abdominal disease, whether the lesion be accompanied by peritonitis or intestinal obstruction. Moreover, bearing in mind that constipation itself may give rise to severe abdominal symptoms, and wishing to eliminate it as a possible cause of confusion, we may be tempted to give purgatives. A dose of castor oil given to a patient who has appendicitis or intestinal obstruction may do infinite harm. Many a patient has been sacrificed on the altar of this form of medical zeal. The effect of a dose of castor oil on an inflamed appendix is comparable to that of moving an acutely inflamed joint, and is likely to be equally harmful. When it is desirable to get an action of the bowels, reliance should be placed on enemas and on these alone.

They are ou rone refuge against the ever-constant danger of mistaking constipation and its results for some other more serious and less easily combated lesion.

An old lawyer once consulted me about some personal ailment. In the course of conversation he expressed a

certain discontent as regards the medical profession. I *asked him why he held such views, and this was his* tale. "One day my dear sister had a bad stomach-ache and I sent for the doctor. He examined her and shook his head, saying he was not satisfied, and would like another opinion. To this I consented, and he brought round Dr. ——. After seeing my sister together they looked grave, and suggested a third opinion. In the course of the afternoon the three doctors arrived. Their gravity had increased and they thought an operation would be necessary. At any rate, they would come and see her again at eight in the evening to make a final decision. Soon after they had gone a nurse, who was an old family friend, arrived. Almost the first question she asked was: 'Has the patient had an injection?' On being told that no injection had been given, she suggested giving one on her own responsibility. This she did with immediate and permanent benefit, and my sister got quite well. Why couldn't the doctors have thought of that?"

This little story is told, not to make fun of the foremost of all professions, but to illustrate what has been said already concerning the value of the enema as an adjuvant in the hand of the diagnostician.

The "Peritoneal Pulse"

The "peritoneal pulse" is commonly found in cases of peritonitis. The characteristics are increased frequency of beat, small amplitude of the wave, and increased tension. A pulse of this nature occurs in

the intermediate stage of peritonitis before the patient has become exhausted. And in any case of supposed peritonitis, the absence of this type of pulse should cause immediate attention and comment. At the same time it must be borne in mind that the peritoneal pulse may be absent although acute abdominal disease is present. For example, in the early stages of a perforated duodenal ulcer within two hours of the perforation the pulse rate may be only eighty or eighty-eight and the features characteristic of the peritoneal pulse may be wanting. Again, the administration of certain drugs, notably of alcohol and morphia, may obliterate the special features that would otherwise be found in the pulse. From which we learn that the presence and absence of a " peritoneal pulse " are both matters of moment, calling for recognition and inquiry.

An interesting case of misinterpretation of physical signs is that of a lady who had been operated upon for appendicitis. Shortly afterwards she was found to have an excessive frequency of the pulse. The surgeon was filled with consternation, and thinking that something must have " gone wrong " in connection with the operation, he reopened the abdomen, but found nothing amiss. It then transpired that the patient was subject to spasmodic tachycardia, of which she had just experienced a phase.

Pyrexia

Concerning the patient's temperature there is little comment to be made beyond what has been said already

concerning the value of individual symptoms. Pyrexia is not necessarily an indication of peritonitis in a doubtful case, for it may be caused by other conditions which do not call for surgical intervention. Moreover, there may be an absence of fever in the presence of peritonitis, especially in the later stages, or when the patient has had to undergo transportation; and a not uncommon event is the arrival of a patient in hospital with a subnormal temperature although there is extensive peritonitis. In the early stages, too, the patient's temperature may be normal or but slightly raised.

Increase of Respiration Rate

Reference has been made already to the possibility of attributing to the abdomen symptoms which originate in the chest. Though not so probable, the reverse of this may happen, that is to say, an abdominal lesion may be misinterpreted as arising in the thorax. One factor in such a mistake is the greatly increased rate of respiratory rhythm that is seen sometimes in cases of abdominal inflammation, especially when the inflammatory process affects the upper part of the peritoneal cavity, as, for example, when it arises from a lesion of the gall-bladder. The reflex necessity in such a case for fixing the diaphragm and lower thorax so much reduces the volume of respired air that a considerable increase in the rate of breathing is brought about, and this increase is often enhanced by the presence of fever.

This source of error is no imaginary one, and experienced physicians have been known to become

sorely perplexed over a supposed affection of the chest when the symptoms were really due to a subphrenic abscess. Of course, the increased respiration rate is not the only sign which may be misread in such a case. Other factors play a part, the diminished air entry at the pulmonary base, especially when it is accompanied by some collapse of lung tissue, are additional features of the puzzle.

Indeed, looking broadly at the matter, the difficulty of distinguishing between disorders of the chest and of the abdomen is no surprising phenomenon, seeing that in the embryo the cavities of the chest and of the abdomen are merely subdivisions of one common compartment with free communication between them. Moreover, although separate from the point of view of gross structure in the adult, pathologically there is intercommunication still. The illustration of such intercommunication is the concurrence or sequence of affections of the two regions of the pleuræ and peritoneum. A patient having some septic process within the abdomen thereafter suffers from pleurisy and perhaps empyema. This was a fairly common experience during the great war, during which it happened on many occasions that where men who had been sucessfully operated upon for gunshot wounds of the abdomen subsequently suffered from pleural sepsis.

The extension of sepsis in the reverse direction also is not unknown, that is, from pleura to the peritoneum.

A remarkable instance of simultaneous lesion of

the thorax and abdomen is the following reported by Lennox Gordon [1]:—

"While on active service in the campaign in German South-West Africa a man was admitted into hospital on account of pain in the abdomen. He had complained for four days of severe pain in the abdomen, which pain had become very acute fourteen hours before admission. He was vomiting and suffered from constipation, but not from obstruction. The temperature was 96; the pulse 80. The pain was in the right hypochondriac region. Liver dullness was present over a zone two inches wide parallel to the costal margin but not above this. Percussion of the right chest in front yielded a tympanitic note from the lower border of the second rib down to the costal margin, breath sounds being absent over this area. The heart's apex beat could not be localised.

"The question of immediate operation for the abdominal symptoms was made doubtful by the lung signs. Nor was it possible to decide whether the thorax or the abdomen was the primary seat of the acute illness. Eventually it turned out that the patient had perforation of a gastric ulcer within the sac of a large diaphragmatic hernia."

This case is an extreme example, and one where correct diagnosis was, humanly speaking, impossible. But it helps to illustrate the possibility of simultaneous involvement of the chest and abdomen in morbid conditions. More frequent sources of error are those in which a wound has involved both cavities, or where one has become the seat of disease by extension from the other.

[1] *B. M. J.*, Aug. 19, 1916, p. 250.

Shifting Dullness in the Flanks

The presence of dullness to percussion in the flanks which gives way to resonance when the patient is turned on his side is sometimes of value as showing the presence of fluid free in the peritoneal cavity. Fluid may be detected in this manner before it is copious enough to cause a percussion thrill. But caution must be used in drawing conclusions; because shifting dullness in the flanks is usually present as a normal condition. Obviously, if a man lies on his back the gaseous contents of his intestine will rise and the heavier contents will fall back; and if he changes his position the intestinal contents change theirs under the influence of gravity. But this normal shifting is less definite and the area of dullness is less in extent—speaking generally—than is the case when a noticeable amount of free fluid is present in the abdomen. With this knowledge in mind, the discovery of shifting dullness in the flank is unlikely to lead us into misadventure.

Loss of Liver Dullness

Obliteration of the liver dullness in front as found by percussion of a patient who is lying on his back may be almost conclusive evidence that the intestinal canal has been perforated. But before the sign can have this value there must be present certain conditioning circumstances. The first concerns the manner in which the physical examination is carried out. To state it briefly, the percussion should be light or moderate, and the note yielded must be deeply tympanitic.

Then again, if tympanites be present, loss of liver dullness loses the most part of its value as a sign. For with a much distended abdomen a resonant note over the front of the liver is common.

Lastly, one must bear in mind that loss of liver dullness may be due to a right pneumothorax, or to the entry of air into the abdomen through an operation wound during laparotomy, or through the diaphragm from a wound of this structure combined with a wound of the lung.

The following may be mentioned as an illustrative case :—

A man received a stab wound of the left lower thorax. On examination a few hours later he was found to have an extensive left pneumothorax. He also had a good deal of pain in the abdomen, and the abdominal muscles were rigid. The abdomen was not distended, yet there was complete absence of liver dullness in front, the percussion note in this region being tympanitic.

From the nature and situation of the wound it was possible that his stomach or intestine had been injured; the abdominal pain and rigidity together with the loss of liver dullness seemed to lend force to this possibility. However, after weighing all the evidence it was believed that the free gas in the peritoneal cavity had found entry through a wound in the diaphragm, and that the abdominal pain and rigidity were attributable to this wound of the diaphragm. This explanation was afterwards proved to have been correct.

The case is a good illustration of the danger that might be incurred by placing too much diagnostic value on the presence of certain individual signs and symptoms,

and by failing to see these in their true proportion by comparison with the rest of the circumstances—which is one of the chief pitfalls.

Posture and Facial Expression

The patient who has an acute abdominal lesion may be expected to assume a certain posture in bed, and by his facial expression to denote the locality of his complaint.

With regard to posture, he probably will lie on his back with the thighs flexed, and the more common departure from this attitude is extension of the thighs. The dorsal decubitus in the adult is an almost invariable concomitant of peritonitis, and, to convey the desired warning, it is only necessary to remark that it is not quite invariable; on rare occasions even an adult with peritonitis may be found lying curled up on his side in bed. With children it is not rare for the dorsal decubitus to be absent even when a severe and acute inflammation of the peritoneum exists; and it is well to carry this fact in the memory in order to avoid an erroneous conclusion.

With regard to facial expression there is this to say, that a typical so-called abdominal facies may be seen in cases where the lesion is not in the abdomen, for example, in acute pericarditis. Accordingly, the evidence afforded by the exhibition of this peculiar *facial expression is of real value only when it is con*sidered in conjunction with the concomitant materials for diagnosis.

It is almost unnecessary to add that the administration of morphia or other anodynes may abolish the typical abdominal facies.

Pelvic Tenderness

A symptom frequently unsought is tenderness of the pelvic peritoneum. In females and children especially much information may be gained in a doubtful case by means of bimanual examination of the pelvis, and it is a method which no surgeon can afford to ignore with a view to diagnosis and localisation.

CHAPTER XI

ABDOMINAL INJURIES

The general remarks which have been made in the preceding chapter on the Diagnosis of Acute Abdominal Disease are obviously applicable to abdominal injuries; nevertheless, there are certain points in connection with the latter which are of such importance that they deserve the special prominence of a separate section to themselves.

Pain.—Grave abdominal lesions due to sudden violence, like severe injuries of other parts of the body, commonly are unattended by pain until an interval of time, measurable by minutes or hours, has elapsed.

This is, at least it ought to be, a maxim of surgery. The converse also is true, that the patient who cries out directly he has been hurt, probably has sustained no great harm. Yet there are many practitioners, and good ones too, who appear to be unware of these salient facts.

A boy of nine years was knocked over by a brougham, both wheels of which passed over his body. The occupant of the carriage at once got out and inquired how much the boy was hurt; but he declared that he was not hurt at all, and subsequently he walked off to

his home, which was a quarter of a mile away from the scene of the accident. A doctor was sent after him to make sure that he was *all right*, and later reported that the youngster had received no damage beyond a few bruises. On the following day, however, the boy was admitted to hospital nearly moribund. He had a complete rupture of his jejunum, from which he died.

Here is another illustration: a girl of four years was walking hand-in-hand with another child at a Sunday-school treat, when the horse in the provision cart took fright and bolted, knocking both the children down. A medical man was summoned at once. He found that one child had a bruised head, but the other—the patient of this note—seemed quite well, indeed she was sitting in a chair eating a piece of cake. Although the wheel of the cart was said to have gone over her, she looked so fit that the doctor did not think it necessary even to examine her. The child sat out the tea and showed *no alarming symptoms until* she was back at home again, when she became faint. She was brought to the local hospital showing signs of internal hæmorrhage. Her abdomen was opened and the spleen was found to be torn across, the rent extending into the hilum. In this case the child recovered, but none the less the doctor who had seen her soon after the injury could not place this satisfactory result to his own credit.

One *frequently hears the comment made in similar* cases where severe abdominal injuries have been received, "it is curious the patient had so little pain." Now it is not curious at all, it is what one should expect.

In the less severe injuries—partial rupture of a rectus muscle, or laceration of the parietal peritoneum, for example—pain may be immediate and intense, but in the great catastrophes threatening life usually pain is absent for some time after the accident has occurred. Both of these facts should convey their appropriate significance.

Internal Hæmorrhage.—Whenever, as a result of abdominal traumatism, unmistakable indications of hæmorrhage have appeared—pallor, restlessness, and so forth—as soon as the initial shock has passed off the *patient should be subjected to laparotomy.*

Not uncommonly there is a temptation to wait and watch, but it must be resisted. Delay in these cases is frequently fatal. For recurrent hæmorrhage is common in the abdomen, especially so after rupture of the spleen. I have known a man die from profuse recurrent bleeding from the spleen a week after the original injury, and have seen other examples in which severe hæmorrhage has recurred after an interval of days during which the patient appeared to be progressing favourably.

Pneumothorax.—Traumatic pneumothorax is easy to mistake for an abdominal injury, and the mistake may be difficult to avoid. In children, and possibly also in adults, violent compression of the lower part of the chest and upper abdomen may cause pneumothorax even in the absence of a fractured rib.

A child has been run over in the street, there is a wheel mark over the upper abdomen and lower thorax; the child clearly has been badly hurt, and there is loss

of liver dullness. What is more easy than a hasty conclusion that some portion of the alimentary canalhas been burst or torn ? A careful examination of the chest, it is true, would reveal the presence of the pneumothorax, but in the circumstances mentioned the chest is not always carefully examined, and consequently the loss of liver dullness is wrongly attributed to the presence of free gas in the peritoneal cavity. In any case, even if the pneumothorax be recognised, the surgeon may be persuaded, unwisely as I think, to open the abdomen without sufficient pause. Perhaps the best course to pursue in these difficult cases is to await developments, keeping a special outlook for a rising frequency of the pulse and other symptoms significant of acute disorder within the abdomen.

Retroperitoneal Hæmorrhage.—An error which it is difficult to avoid is the performance of laparotomy in cases of retroperitoneal hæmorrhage. I suppose every surgeon is caught now and then in this trap, for the means by which it may be circumvented are not clear. At the same time the error is worthy of mention both because a means of escape is more likely to be found if earnestly sought, and because in most instances in which one has performed a laparotomy and found only a retroperitoneal hæmorrhage one's mind has been pervaded beforehand by instinctive doubt, the origins of which, however, defy minute and detailed analysis, though they are none the less significant; to some extent they illustrate the bearing of what has been said in the previous chapter upon the art of diagnosis.

do. The moral is clear enough: we must not only make a thorough general examination of the patient, to make sure that the source of his illness really does abide in the abdomen, but we must also use whatever methods are available for showing in what particular part of this cavity the trouble lies. Perhaps to neglect the evidence of radiographic investigations after a bismuth meal is one of the commonest of the culpable omissions.

Anæsthesia.—Competent anæsthetists are essential for good abdominal surgery. One of the common difficulties in the performance of an abdominal operation is to keep the intestines inside the peritoneal cavity or to replace them after they have escaped through the incisional opening. It is not conducive to a good result if, for example, during an operation for intussusception in a baby, a large portion of the intestines remain outside the abdomen during the necessary manipulation of the bowel. For exposure of intestine causes shock. The assistant may do much to prevent extrusion of the intestines, but the anæsthetist can do more; because in the absence of reflex contractions of the abdominal muscles the bowels can with ease be prevented from escaping. Possibly it is sometimes beyond the power of an anæsthetist to produce a satisfactory relaxation of the abdominal muscles without overstepping the line which lies between safety and danger. But this is certain, that the better the anæsthetist the more successful is he in avoiding troublesome straining on the part of the patient during the operation.

Every surgeon of experience will readily call to mind

instances in which an operation has been unduly prolonged and dangerously complicated by such lapses from efficient anæsthesia. In such circumstances, shock and prolongation are not the only dangers, for with a patient straining it may be most difficult to suture the peritoneum accurately together. And failure to secure *accurate apposition of the cut edges of the* peritoneum may lead to troublesome consequences of pain and perhaps intestinal obstruction owing to adherence of the underlying viscera to the abdominal wall. I have myself seen a secondary operation performed for the relief of intestinal obstruction due to this cause.

Another danger is the escape of intestine through an *opening left in the imperfectly sutured peritoneum.* Carey Evans [1] records an instance in which this occurred after a gastro-enterostomy. "Sûture of the abdominal wall," he says, "was the most difficult part of the operation on account of the rigidity of the abdominal muscles." Intestinal obstruction followed, for the relief of which a second operation was undertaken, and "a coil of small intestine was found gripped by the muscles in the lower part of the wound."

Suture of the Wound.—Apart from accurate apposition of the divided peritoneum, there are certain other points in connection with the closüre of abdominal wounds to which attention must be directed.

As a rule, I think, special muscle sutures are futile. *Muscular tissue is too soft to hold sutures against a* strain, and in any case the muscles, unless cut across

[1] *Lancet*, Vol. II. 1907, p. 1461.

transversely, will come into their proper places when the aponeuroses have been drawn together. These aponeuroses are the barriers which prevent the formation of subsequent hernias. They must therefore be sewn together accurately with material which is sufficiently durable and strong to withstand the efforts of vomiting. Chromicised catgut is a suitable material, but its use necessitates the observation of certain precautions. Many surgeons rely upon a single, continuous catgut suture to unite the aponeuroses, but this practice is attended with considerable danger of subsequent bursting open of the wound. This unpleasant and dangerous mishap is no great rarity. I have seen several examples myself and have heard of others. The one common feature in all has been the use of a continuous catgut suture to unite the aponeuroses. I believe that the knot is the weak point, for catgut knots are not very secure, as any surgeon can demonstrate to himself during an operation by cutting short one end of a knotted suture and pulling on the other end.

If, therefore, the fascia be united merely with a continuous suture of catgut, there will be a definite, though possibly slight, element of danger in every case; but the danger will be much lessened if the surgeon makes a habit of testing the knots before completely closing the wound, and if in addition to this he leaves the cut ends fairly long—say one centimetre. Personally I prefer, in addition to these precautions, to use a few reinforcing sutures of strong silkworm gut passed through the skin superficial fascia and abdominal aponeurosis.

As in all other operations, the best scars are only to be obtained by accurate approximation of the edges of the skin. For this purpose it is well to make with a needle some light scratches on the surface of the skin transversely to the intended line of the incision before commencing the operation. These scratches will serve as guides when the time for closure of the wound has arrived.

Drainage.—So-called gauze drains are still used by some surgeons when it is necessary to provide for the escape of discharges from the abdomen after an operation. They have many disadvantages. Their removal entails excessive pain; they act as drains only until the discharges contained in their meshes have become coagulated, after which they act as dams; they become adherent to the viscera and cause them damage, and on their removal adherent omentum may be drawn into the space in the abdominal wall which the gauze "drain" occupied. I think for these reasons their use should be discontinued, rubber tubes or small rolls of rubber sheeting being used in their stead.

Some, if not all, of the ill fame attached to the rubber drainage tube is attributable not to the method but to its misuse. Sometimes the tube used is much too large. I have seen a tube an inch in diameter employed to drain the pelvis. Such a large tube is not necessary; moreover, it causes discomfort to the patient and encourages the formation of a hernia later on. In one instance I saw intestinal obstruction caused by a portion of the wall of the small intestine becoming

strangulated in one of the lateral fenestra of a large rubber pelvic tube used for purposes of drainage after a laparotomy.

Though it is difficult to lay down any definite rule as to when drainage tubes should be removed, it can be asserted without fear of contradiction that they often are retained too long. Such a retained tube itself becomes a focus of suppuration. I have seen a tube allowed to remain in position for five weeks after an appendix abscess had been opened. Pus had continued to escape so freely that the surgeon had been afraid to remove the tube. Needless to say, as soon as the tube was extracted the flow of pus became greatly reduced and the wound rapidly healed.

Sometimes a temporary panic ensues after removal of a drainage tube owing to a rise of the patient's temperature, and this may lead the surgeon to think that his action has been premature and to fidget about with the wound under the impression that pus is collecting within its depths, whereas all is well. A transient pyrexia is a common sequel to extraction of a drainage tube and is without special significance.

An occasional consequence of prolonged retention of a drainage tube is damage from pressure upon the structures with which it lies in contact. In this way may be brought about intestinal obstruction, fæcal fistula, and hæmorrhage or thrombosis from injury to the iliac vessels.

Foreign Bodies mislaid in the Abdomen.—Seldom does one hear of instruments being left by inadvertence

in the abdomen. Yet such accidents have happened, pressure forceps apparently being the articles most likely to be lost in this way. General wariness is all that is required in order to avoid the mishap; though an additional help is to use only long-handled pressure forceps.

Much more frequent than the loss of an instrument is the loss of a swab. To prevent this awkward oversight it is a common recommendation to have the swabs counted both before and toward the close of a laparotomy. This plan is not so successful as might be expected. In one well-known instance the nurse counted over the swabs twice, and twice stated that the numbers were correct, and yet one had been left in the patient's abdomen, and the surgeon had to pay heavily for the mistake. It is safer, in addition to counting the swabs or packs, to make a rule never to insert any into the abdomen unless they have tapes attached to them, and to take care that the tapes remain outside by clipping them with forceps. Small swabs should be banished from the field of operation. I was present on one occasion at a post-mortem examination in which a small swab was found in the abdomen—to the great surprise and consternation of the surgeon who had done the operation. The explanation was that he had been helped by an inexperienced assistant. And as surgeons often are obliged to operate with the help of men who have seen little of abdominal surgery, it is well to put small swabs out of the reach of their hands.

Difficulties have arisen, and have led to an action

at law, owing to a swab which had been inserted into the lumen of the intestine to prevent the escape of fæcal material during a resection, having been forgotten. *This method of arresting the flow of intestinal contents is not to be commended.*

At post-mortem examinations upon patients who have died after undergoing abdominal operations I have several times observed threads of silk or catgut lying loose in the peritoneal cavity; and I have seen a piece of indiarubber from a glove, probably a patch which had become detached, in this situation also. I have reason to believe that threads accidentally left in the abdomen, if not too coarse, may, in women, be extruded from the peritoneal cavity *viâ* the Fallopian tubes.

Not long ago I operated upon a nurse for a pelvic abscess, and inserted a tube into her pelvis for drainage. She made a good recovery; but when I met her again after an interval of three months she told me that a little abscess had formed in the scar and burst, and some sutures had come away together with a little piece of indiarubber which evidently had been snipped out of the drainage tube when making the lateral holes. Needless to say, I was rather shocked to be told this, and made a mental note to be more careful with my trimmings in the future.

A medical friend tells me that a patient of his suffered from an abscess in the front of one of her thighs. He opened the abscess and withdrew from it a curved surgical needle threaded with silk. Eighteen months previously the patient had undergone laparotomy.

Posture after Laparotomy.—As soon as the immediate shock has passed off the patient should be propped up in bed and supported in this position. Fowler's original reasons for advocating this posture may be called into question, but whether they do or do not hold good, there can be no question about the relief which the sitting position affords the patient by the reduction of the tension which it effects in the abdominal wall.

Tympanites.—The amount of pain which patients suffer after laparotomy is variable. Some say they have but little pain, others suffer much. To the latter there may be a temptation to give morphia. The objection to this is that while relieving the pain for the time being it is apt to lead to an increase of tympanites, which is the most frequent of the unpleasant sequels of laparotomy.

The two best remedies are turpentine enemata and repeated hypodermic injections of pituitrin, and one or other or both of these measures should be employed early without waiting until the patient is so distended that he can hardly breathe. The subject is discussed more fully in the chapter on appendicitis, to which the reader is asked to refer.

Post-operative Vomiting.—Excessive sickness after the operation may be due merely to the effects of anæsthesia, or it may be the result of uræmia, acidosis, or one of the multitudinous causes of vomiting. The more important causes are peritonitis and intestinal obstruction; and the differentiation of these need not be considered here, as the subject is dealt with in another

section. But reference must be made to a type of case which has an importance of its own. A patient who has been operated upon for an inflammatory condition of the appendix or pelvic organs, we may suppose, does not make a good recovery. The abdomen remains somewhat distended and tender, and there is pyrexia and occasional vomiting. Perhaps there is a continual difficulty in getting the bowels to act. In such a condition we should always be on the look-out for a residual pelvic abscess. Unless this be thought of as a possible explanation of the delayed convalescence, or unless a timely rectal or vaginal examination be made, the condition is apt to be overlooked and to get out of hand.

Acidosis is an occasional pitfall. The diagnosis is easily made if the urine be tested with ferric chloride; but unless the condition be suspected, and appreciated as an important clinical occurrence, the urine will not be tested with ferric chloride, and the sickness will be erroneously attributed to some other cause. And this is likely to lead to disaster. Acidosis, if detected in time, is easily and quickly cured in most cases by suitable dietetic treatment, that is to say, the free administration of carbohydrate food, supplemented if necessary by giving subcutaneously or by the bowel sufficient quantities of a solution of glucose; but if the real nature of the condition be overlooked and the patient is consequently starved, or fed merely on milk or albumen water, he will die.

CHAPTER XIII

APPENDICITIS

The majority of misadventures in appendicitis arise in connection with the diagnosis. The pitfalls among which the surgeon has to thread his way in order to gain a clear and unobstructed contact with the disease are innumerable. So difficult is this matter that the most crafty of experienced practitioners will be deceived now and then. The careless and inexperienced will err perpetually. The essential fact is that the diagnosis is a matter of intelligent guesswork. Without a laparotomy, the appendix can neither be seen nor handled. The inferences that may be drawn from such indirect evidence as may be available, as is usual with conclusions founded on indirect evidence, are very apt to be wrong. The sources of confusion are not confined to the abdomen, for they include certain general disorders, as well as thoracic and other extra-abdominal lesions.

General Disorders.—Among the manifestations of lead-poisoning, locomotor ataxia, severe anæmia, acidosis, arterio-sclerosis, urticarial erythema, Henoch's purpura, and certain other general ailments, not rarely are included pain in the abdomen and vomiting. These accompaniments may be misinterpreted to mean that the appendix

is inflamed; and, unless patients be thoroughly and systematically overhauled as a routine, discreditable occurrences are sure to arise. The most casual reflection would show that vomiting and pain in the abdomen are insecure foundations on which to build a diagnosis of appendicitis. Yet it seems that such reflection is often wanting.

Lead-poisoning. — Concerning plumbism—and the tenor of the remark is applicable to several other conditions with equal force—there are two ways in which the surgeon may be misled. On the one hand, he may fail to observe that the patient has a blue line on the gums, pallor, and perhaps wrist-drop; he may, and often does, omit to carry his inquiries further than the abdomen itself, and consequently becomes responsible for the performance of an unnecessary laparotomy. On the other hand, the surgeon may perceive the evidence of lead-poisoning, and may be so dominated by the discovery as to ignore the fact that the patient has appendicitis in addition. Lockwood,[1] quoting Le Gendre, has referred to such an instance in which, owing to the recognised presence of plumbism, a gangrenous appendix was overlooked, with disastrous results.

Although it is not easy to excuse the oversight of well-marked lead-poisoning, one can readily see how facile it may be to disregard the appendicitis which is invisible when we can see without a doubt the blue-line on the gums and other signs of saturnism. When two distinct lesions coexist in an individual

[1] "Appendicitis," p. 222.

it is often impossible to appraise the morbid value of each one. Nevertheless, we should make the attempt.

Locomotor Ataxia.—The visceral crises of tabes dorsalis have been misconstrued as evidence of appendicitis. Apart from reiteration of the necessity for complete examinations of all patients supposed to be suffering from abdominal disease, I have little to say, except that it is not sufficient to rely upon the pupil reflexes alone. Slight deafness, anæsthesia to light touch over certain cutaneous areas, loss of knee-jerks, perforating ulcer of the foot, visceral crises, may precede the abolition of the light reflex of the eye in a case of locomotor ataxia.

Acidosis in children, and in grown-ups, is a quite common condition, and although the subject has been mentioned already in connection with head injuries, it is necessary to refer to it here again, because of the frequency with which it leads to a mistaken diagnosis of appendicitis, and because of the peril with which such an error is fraught. For the administration of an anæsthetic to an individual with acidosis is likely to prove fatal.

The following example carries its own morals. I was asked to see a little girl of six with a view to operating upon her for appendicitis. She had pain in the abdomen together with persistent vomiting. I was informed that she was being given nothing but albumen water, but even this she was unable to keep down. She had suffered from similar though less severe, attacks in the past.

The child was drowsy, did not have a peritoneal pulse, was tender over the epigastrium—probably as a result of the vomiting—but there was no tenderness or rigidity over the appendix. I did not think she had any primary abdominal lesion, but she did look like a case of acidosis. On examination of her urine a heavy diacetic reaction was obtained. I advised that the child should be given some dry toast to eat—advice which caused consternation, displeasure, and some opposition. However, I had my way. The child ate the toast and kept it down. Indeed, from the moment at which a carbohydrate diet was commenced the vomiting entirely ceased, and the patient began to recover.

Subsequently, while abroad, the child had another and similar attack; and a surgeon who was called in diagnosed appendicitis, broaching the subject of operation. The mother, however, produced a note which I had advised her not to part with, and which mentioned the girl's liability to acidosis. The urine was examined, acetone was found, and again the child was restored to health by a rearrangement of her diet.

The possibility of acidosis being due to the vomiting and starvation which themselves are consequent upon appendicitis must be taken into account. But in any case it is of paramount importance to recognise the presence of diacetic acid and acetone in the urine before an operation is performed, in order that immediate remedial measures, that is to say, the supply of sugar or other carbohydrate sustenance in adequate amounts, may be taken. Otherwise there will very likely be

an unexpected fatality from so-called delayed chloroform poisoning.

In those cases in which acidosis follows an operation and the vomiting is so severe that the patient cannot get advantage from carbohydrates given by the mouth, these should be administered by the rectum, and also, if the symptoms are severe, by subcutaneous or intravenous injection in addition. A five per cent. solution of natural glucose is suitable for use in this way. Commercial glucose is to be shunned.

To avoid these troublesome cases it is a good precaution to give a generous proportion of carbohydrate in the diet prior to any operation requiring a general anæsthetic.

Concerning the other general disorders which give rise to abdominal manifestations, such as arteriosclerosis, calcified arteries, erythema multiforme, Henoch's purpura, and so forth, nothing more will be said, because their discussion would occupy too much space. After all, the lessons they teach are all alike, namely, to examine the patient thoroughly, to observe such things as purpuric spots, patches of erythema, hard arteries, an enlarged heart, and above all to learn to diagnose a disease by its *tout ensemble* rather than by individual features.

Thoracic Lesions.—Right-sided pneumonia, pleurisy, and empyema may bring about pain referred to the right side of the abdomen with rigidity of the abdominal muscles; and there are instances innumerable

in which the surgeon has looked inside a patient's abdomen expecting to find an inflamed appendix or peritonitis from some other cause, and has been disappointed, while subsequent events at the bedside or in the post-mortem room have demonstrated that the malady lay within the thorax, and might have been recognised had the trouble been taken to carry out a proper clinical examination of the patient.

Cardiac Lesions of various kinds are also sources of error. A patient was suddenly taken ill with intense abdominal pain accompanied by rigidity of the muscles and some collapse. Laparotomy was performed and nothing definitely abnormal was found. The appendix was removed, although to the naked eye it did not appear to be diseased. After the operation the pain was gone, but in the course of a day or two the patient had a sudden pain in the left hypochondrium, thought to be due to an embolus in the spleen. This led to a more thorough clinical overhaul of the patient, who was found to have endocarditis.

Spinal Caries, especially when associated with abscesses in the psoas muscle, may readily be confused in some instances with appendicitis, for in these cases the patient may refer all his pain to the abdomen, while he lies with his hip-joint flexed in order to relax the affected muscles, and he is tender in the region of the appendix. The history of the case and the rigidity of the spine are especial features of distinction, though there are others of a nature which is less readily defined.

I have known the reverse mistake to be made. The

patient, who had an appendix abscess, referred all the pain to his back, a feature upon which the surgeon who saw him laid great stress, saying that never in his life had he known a case of appendicitis in which the pain was entirely referred to the back. He was misled nevertheless.

Hip Disease.—The appendix lying in the iliac fossa is in close relationship with the iliacus muscle. Consequently, when the appendix is inflamed, and especially if it has given rise to a retrocæcal abscess, the hip-joint will be retained in a position of flexion, and any extension of the thigh will cause pressure or tension on the inflamed tissues and consequent pain. This flexion and limitation of the hip may lead to a diagnosis of hip-joint disease when the condition is in fact appendicitis. Examples of such a misinterpretation have been referred to by Lockwood.[1]

Diseases of the Kidney may be confused with appendicitis on account both of their general effects and also their local disturbances. Thus, the vomiting of uræmia, accompanied as it so often is by pain and tenderness in the abdomen, may lead to the supposition that there is some disorder in this region which requires surgical intervention. And if the surgeon who is called in omits to examine the urine himself, he may be led into an indiscreet and most ill-timed laparotomy, an event to which I have been a witness.

However, the commonest cause of misapprehension is a calculus impacted within the ureter, to which a

[1] *Loc cit* p 195

clue may be found in the discovery by the microscope of red blood-cells in the centrifugalised deposit of the urine. It is well to bear the possibility in mind, and to examine the ureter during the laparotomy, if an appendix be found which appears to be normal.

In any case a careful history will usually provide material for distinguishing these two conditions, or at any rate for putting us sufficiently on guard to demand an X-ray examination before opening the abdomen. Nevertheless, and with every care, misconceptions cannot invariably be eschewed. For it is a remarkable fact that increased frequency of micturition accompanied by hæmaturia may be associated with, and apparently caused by, appendicitis. Whatever the pathology may be, the urinary symptoms disappear after the appendix has been removed. In a case of a retrocæcal abscess due to appendicitis great difficulty was experienced in establishing a correct diagnosis. There was profuse hæmaturia with pus and a few granular casts in the urine. The abscess was situated rather high up in the abdomen, and a radiogram showed the presence of a concretion which might have been a renal calculus, but which proved to be a fæcal concretion. The urinary symptoms rapidly and completely cleared up after drainage of the abscess.

The following is an example of a miscalculation which brought about disaster. A strong, vigorous man was suffering from symptoms which were thought to be those of a right-sided renal colic. He was treated in the manner usual for this complaint, that is to say,

with hot fomentations and hypodermic injections of morphia. After a week of this treatment his doctor began to get anxious and called in a surgeon. The abdomen was found to be distended but not tender, the temperature was 97·6°, the pulse 112 and soft, the tongue brown and dry, and the pupils contracted. The patient in fact was *in extremis* from general peritonitis. An operation was performed as a forlorn hope, but the patient succumbed. The morphia had completely masked the symptoms.

Pyelitis of Pregnancy is a constant source of diagnostic errors. The condition is seen most commonly at about the sixth month of pregnancy, and if recognised in time it may be cured easily enough by keeping the patient in bed, and perhaps giving some urinary antiseptic. Unfortunately, the true state of affairs is not always recognised, and the symptoms are judged to be those of appendicitis. On two occasions I have been asked to operate upon a pregnant woman for a supposed appendicitis, when there has been abundant albumen with pus in the urine and the patient has been suffering from unrecognised pyelitis; and in another instance I saw a lady with this condition whose appendix had already been removed without any relief of the symptoms. Pyelitis is a not uncommon complication of pregnancy, and the practitioner cannot fail to recognise the disorder if he takes the trouble to examine the patient's urine and knows how to interpret what he finds there.

The abdominal conditions which may be misread as appendicitis include constipation, gastric and duodenal

ulcer, cholecystitis and gall-stones, tuberculous peritonitis, various lesions of the pelvic organs, intussusception, malignant disease of the bowel, and intestinal obstruction due to various causes. To describe illustrative cases of every one of these would be wearisome. The chief lessons to be learned from them are (1) the value of an accurate history, (2) the absolute necessity for a thorough examination of the patient, and (3) the fallacy of relying upon individual symptoms. I have seen a man, suffering from a perforated appendix, who was sitting in front of the fire complaining of severe pain around the root of his penis, with a temperature of 99° and a pulse of 88. There are several features here that are unusual in the presence of appendicitis. Nevertheless, the diagnosis was not difficult when the history had been carefully ascertained and the symptoms were regarded as a composite whole.

To overrate the importance and significance attaching to the presence or absence of certain individual symptoms is perhaps the most prolific fountain of error. The abdomen is not tender, therefore the patient has not appendicitis—this would be a useful and convenient rule if diagnosis could be turned out by machinery. More often than not the conclusion would be correct. But *it would sometimes be wrong. If the inflammation* be confined to the pelvis there may be no appreciable abdominal tenderness, and the same is true if the patient has been doped with opium or alcohol. Tenderness may be rendered inconspicuous by a fat abdominal wall, while it may be absent from other causes in the

presence of peritonitis. The patient himself may deceive wittingly or unwittingly. He may say that there is no tenderness because he wishes to appear plucky, or because he is hoping to avoid an operation. On the other hand, he or she may complain of tenderness when none is present.

So it is with every one of the symptoms. Considered singly and separately they are fallacious guides. To recognise individuals we do not as a rule rely upon the characteristics of one particular feature. A lady has but to cover up the lower part of her face and her own husband will pass her by. And so it is in the recognition of a disease. We must uncover all its features and contemplate them as a whole. In this lies the art of diagnosis and the avoidance of error.

Resulting from appendicitis, there are two gross lesions which are especially liable to be misinterpreted; at least the surgeon is apt to overlook their origin even when he has discovered the lesion. *Subhepatic abscess* due to the tracking upward of pus, or to an abnormally placed appendix, is one of these. It is true that such an abscess may be drained, and the patient may make a good recovery without the source of the trouble ever being discovered. But this is not always so, and in any case the surgeon ought to have too much pride in his work to accept easily a diagnostic defeat of this kind. A simpleton may perhaps drain an abscess with success, but it may demand a sharp intelligence to make the correct diagnosis.

A boy arrived in hospital with a large subhepatic

collection of pus. This was opened and drained, but a sinus remained and refused to heal. Eventually, and after prolonged invalidism, a fæcal concretion was extracted and the sinus closed spontaneously. In this case apparently no endeavour had been made to identify the source of the abscess or to discover the presence of a fæcal concretion or other foreign body. Had the pus been submitted to a pathologist, as it ought to have been, it is possible that the presence of intestinal flora would have given a clear lead. And other features might have pointed to an appendical origin had the possibility been fully considered.

Pelvic Abscesses having a diseased appendix as their starting-point are not infrequently overlooked. In the earlier stages there may be no appreciable tenderness of the abdomen and but little pain. Moreover, what pain there is may be of a colicky nature, and the symptom may be misregarded as due to a partial blockage of the bowel, the collection of pus being unsuspected. A pelvic examination is all that is required to clear up the matter of the diagnosis. One precaution is necessary, however, and this is to empty the bladder first, for a large collection of pus in the cavity of the pelvis and a distended bladder feel much alike.

A curious example of an appendix abscess being entirely overlooked by the medical attendant until it burst spontaneously came under my notice. The patient, who was well-to-do, suffered one day from severe pain in the abdomen with vomiting. She sent for her doctor, who did not examine her abdomen but contented

at one time or another, including intussusception, envelopment by adhesions or a band, malignant disease, strangulated retroperitoneal hernia, enterolith, and other conditions. The seriousness of such diagnostic errors is greatly enhanced when removal of the appendix is attempted through a small aperture, and especially if a gridiron incision be employed. Not only may the surgeon, in these circumstances, remove the appendix and overlook the major lesion altogether, but even if he recognises this he may find himself to be greatly hampered in his work by the smallness of the abdominal opening.

Ulceration of the Pylorus and Duodenum.—Chronic appendicitis causes a dyspepsia which is often difficult and sometimes apparently impossible to distinguish from that due to a duodenal or pyloric ulcer. Probably the general mechanism of the indigestion in these cases is similar; that is to say, it is brought about by a reluctance of the pylorus to expand and allow food from the stomach to traverse the affected portion of the bowel. The most reliable distinctive feature, when other definite localising indications are absent, is the irregularity and variability of appendix dyspepsia as compared with that due to pyloric and duodenal lesions. But this is not an absolutely successful means of discrimination, and I have no doubt that other surgeons, like myself, have not infrequently found themselves unable to form a correct opinion before opening the abdomen.

Delayed Operation.—Once appendicitis has been diagnosed there seldom can be sufficient reason for postponing operative measures indefinitely. Even if

the attack has been a mild one and already shows signs of subsidence, there is no guarantee of immunity from a second onslaught which may be severe. A man of my acquaintance was advised by his doctor to forego operation on the ground that he might never get another attack. He took this hapless counsel, with the consequence that the appendix perforated at a peculiarly awkward time, and he lost his life. C. B. Lockwood [1] has recorded a case in which an operation for recurrent appendicitis was put off because the patient's wife was expecting to be confined in a month's time. During the interval, however, the patient developed portal pyæmia from which he died.

Allusion has been made already to the hazardous delays and failures of diagnosis which result from the administration of morphia. But it might have been thought that it would be safe enough to give opiates once the disease had been recognised and operative interference decided upon, were it not for the warnings of past experience, which teach us that even at this period discretion must be exercised in the use of drugs for the relief of pain. For the effects of these may be so pronounced that the patient is deluded into thinking that he is much better and therefore insists upon the operation being deferred.

Operations for Appendicitis

The Incision.—Much has been said and written in favour of the "gridiron" incision, and it is in vogue.

[1] *Loc. cit.* p. 119.

The fashion is based upon the supposition that other incisions do not leave such a strong abdominal wall. My own belief is that this premise is false. Ventral hernias do not follow incisions through the sheath of the rectus, provided that the aponeurosis is properly sutured and the wound heals by first intention. And if these essentials are wanting, weakness and bulging of the scar are likely to follow any kind of incision. On the other hand, the gridiron incision has some inherent drawbacks. It provides but a small hole through which to carry out the work in hand; and if more room is found to be desirable it is not easy to obtain without inflicting unpleasant damage upon the abdominal wall. An appendix bound down by adhesions, perhaps in the pelvis, may be difficult to remove on account of the insufficient exposure. Besides this, it is often desirable to get a view of other viscera than the appendix, and a gridiron incision is not well adapted for this purpose. For general requirements a vertical incision through the right rectus sheath is to be preferred, the rectus muscle being retracted inward, and the posterior layer of its sheath with the peritoneum being divided transversely—that is to say, in the line of the fibres. These incisions need be made only sufficient for the insertion of two fingers at first, while if difficulties and unexpected conditions are met with, the cuts in the skin and anterior rectus sheath can be extended upward and downward, while the posterior sheath can be cut through vertically for any length that may be desirable, care being taken to retract the nerve which

passes to the rectus muscle across the path of this incision. In this way we can secure for the patient the great advantage of a minimal incision in every case in which such an incision is justified; and these advantages will include, among others, a freedom from subsequent ventral hernia. At the same time we shall not be inflicting upon him the risk that we may be unable to deal adequately with his ailment through the small incision with which we have started, while we cannot enlarge the wound without causing serious damage to the abdominal wall.

The Deep Epigastric vessels have to be avoided in this incision, and if by any chance they are accidentally wounded they must be securely ligated. This matter will be referred to in a later page.

Difficulty in finding the Appendix.—The best guides to the appendix are the longitudinal muscle bands of the ascending colon, which pass over the cæcum to end in the appendix. And provided the abdominal wound is such as to provide a good exposure, difficulty is not likely to arise unless these longitudinal bands are obliterated as the result of inflammation. The principle to be followed in searching for the appendix is to depend upon vision rather than upon tactile sensation. I have heard a surgeon, hunting for the appendix with a finger and thumb in the wound, suddenly remark, "Here it is; I have it. By Jove, it must be badly inflamed, I can feel it pulsating. Wait a minute; it isn't the appendix at all—it's the iliac artery." Which shows how much amiss the fingers may be.

Even in the presence of an abscess, it is well to make some endeavour to find and remove the appendix, because if it be left behind further trouble may come about at a subsequent date. Supposing that the appendix cannot be found without running more risk than can be justified, a careful digital search should be made for concretions; for a retained concretion may be the cause later on of a persistent sinus that will be a great inconvenience to the patient, and to the surgeon a source of perplexity and embarrassment.

In some cases the appendix is firmly bound down by dense adhesions throughout its length. If we try to remove it entire we shall require perhaps a difficult and tedious dissection, and owing to the destruction of the peritoneal coat and the loss of distinct outlines, we may inflict damage upon the viscera to which the appendix is adherent. Therefore it is often better in these cases to decapsulate the appendix. To effect this a longitudinal incision is made through its peritoneal coat where this is exposed, and then as a rule the muscular, submucous, and mucous coats can be readily stripped out and removed. If difficulty is met with the muscular coat may be incised, and the mucous and submucous linings alone extracted. The easiest plane of separation lies between the submucous layer and the muscle.

Accidental Wounds of Bladder and Bowel.—One has several times seen a partial damage to the cæcum during the removal of an adherent appendix, but no great harm appears to arise out of these injuries, and I have not come across any case in which the bowel has

been actually opened. But I have known two instances in which the bladder has been perforated. One was a case of my own. The patient, a morphino-maniac, with the help of his favourite drug, had allowed a pelvic appendical abscess to attain very large dimensions before seeking medical assistance. He was extremely ill, and I did no more than make a small suprapubic opening and insert a drainage tube. On the following day urine was escaping together with the pus from the wound. Probably the fundus of the bladder was held up by adhesions and so was nicked when the abdominal wall was incised.

In the second case the appendix was found to be adherent to the bladder-wall, which was torn through during an attempt to separate them. The injury was recognised at the time and the wound was drained. Urine ceased to escape in the course of a few days. Both of these patients recovered, and it is noteworthy that in neither case did symptoms of cystitis arise.

Drainage.—Manifestly there must be no hesitation to use drainage if the patient is thereby rendered secure from death. It is plain also that the smaller the tube used and the sooner it is removed the better chance will the patient have of obtaining a good scar and of avoiding a ventral hernia later on. These two considerations require adjustment. Speaking broadly, there is a tendency to use tubes which are too large, and to retain them too long. Seldom is a tube required the diameter of which is more than one-third of an inch, and rarely is it necessary to retain it for more than six days.

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hours. The chief ingredients were bismuth and opium! For the entire week the patient had been swallowing this in addition to ounces of castor oil and other purgatives. He died, as I believe, from tympanites, or perhaps it would be more correct to say from the results of continued arrest of peristalsis due in the main to morphia; though it is not quite certain that peritonitis was absent, because no post-mortem examination was made.

Hæmorrhage.—I have seen an account in the literature of an instance of fatal hæmorrhage from the iliac artery owing to pressure upon and ulceration of its wall by a drainage tube; but I have mislaid the reference. The accident can have happened only with a drainage tube too long retained, or at any rate too long retained without being shortened.

But on two occasions I have seen post-operative hæmorrhage from the deep epigastric artery. A patient had undergone a straightforward operation for removal of the appendix, and the abdomen had been closed without drainage. The operation had been performed in the morning, and I was asked to see her in the evening of the same day, as the surgeon who was in charge of the case could not be communicated with. I found the patient pallid and restless, and obviously suffering from internal hæmorrhage. There was a big hæmatoma in the abdominal wall, and on opening up the wound a large quantity of blood was found in the abdominal cavity. The deep epigastric artery was found to be spurting.

The deep epigastric vessels lie beneath the rectus

muscle, and not only may they be wounded unintentionally with the knife or scissors, but the accident may be overlooked owing to the bleeding being temporarily arrested by the pressure of a retractor. Moreover, they may be punctured by the needle or otherwise injured during the process of sewing up the peritoneum.

Though I have been on the look-out for the mishap, I have not yet come across any instance of post-operative bleeding derived from the artery of the appendix. But the possibility seems to be a real one, and therefore it is always well, before closing the abdomen, to inspect the stump of the mesentery of the appendix to make sure that the artery has been properly secured.

Peritonitis.—Localised peritonitis due to infection around the appendix and arising from that organ is, of course, frequent, and is merely a continuation of the process which was present before the operation. It usually subsides rapidly after the operation. But it may spread and bring about a pelvic abscess or a generalised peritonitis. A pelvic abscess should be suspected if the temperature remains raised, the abdomen continues to be somewhat distended, and there is continued difficulty in keeping the bowels empty. There may be but little pain, but the patient looks ill, vomits occasionally, and perhaps has some pain or discomfort during micturition. A rectal or vaginal examination will reveal the reason of the continuation of symptoms.

Generalised peritonitis is a rare sequel to appendicectomy as performed under modern conditions, except in those cases in which it was already present at the

time of the operation, and therefore so far as concerns the surgeon was unavoidable. Anyhow, there is nothing particular to be said about it here.

Intestinal Obstruction may arise at a relatively late date after an operation for appendicitis, being due in this case to the gradual contraction of adhesions causing a sharp kink of the bowel or strangulation by a band.

But there is another class of case in which the obstruction—it may be partial at first—comes on early, in fact it seems to date from the operation itself. As in the cases which come on late, the complication is most to be feared when an abscess has been present and attempts have been made, successfully or unsuccessfully, to find and to remove the appendix. And I cannot help feeling that, in these instances, the obstruction is in some cases a direct consequence of the surgeon's manipulation. I confess to having no proof of this; but have thought once or twice when removing an adherent, retrocæcal appendix, that if one did not take special care to restore the lower end of the ileum and the cæcum to the position they occupied at the commencement of the operation, intestinal obstruction might readily ensue. One's imagination may be a correct guide in this matter. At any rate, I think the point is worth bearing in mind. It is the only suggestion I can offer for avoiding one of the most distressing and refractory of the complications which may follow an operation for appendicitis.

Thrombosis of a systemic vein and pulmonary embolism may supply a tragic ending to a patient after

appendicectomy, just as it may after any operation. Probably it is attributable to a mild, staphylococcal infection spreading to the iliac veins through their tributaries, and especially through the deep epigastric vein. If this be so, avoidance lies in careful technique. Starvation, and also the maintenance of a milk diet, are said to favour thrombosis, and the low blood-pressure of shock may contribute.

Quite another cause is the injudiciously prolonged pressure of a drainage tube upon the external iliac vessels.

Portal Pyæmia.—But more to be feared than thrombosis of the systemic veins, is a septic phlebitis of the veins of the appendix itself, brought about by direct extension of the infection from the appendix into these channels. It is not very rare to find the mesenteric vein thrombosed when removing an appendix, from which it is seen that portal pyæmia does not invariably follow phlebitis of the main vein of the appendix. Nevertheless, there is a real danger of septic emboli being carried to the liver and there setting up a fatal infective process. The only means of escaping from the complication may be described as anticipatory; that is to say, by avoiding all delay in removing an appendix, once an inflammation of this organ has been recognised. An example which points this moral has been given on an earlier page.

Fæcal Fistula is an occasional sequel to the operation. It may be that the stump of the appendix and the cæcum in its immediate neighbourhood may have lost their suppleness and cannot be inverted, or that a per-

foration has occurred at the junction of the cæcum and appendix and cannot be closed for similar reasons. In other instances a fæcal fistula has *arisen from ulceration* of the bowel owing to the pressure of a drainage tube. But however arising (if we omit certain rare cases of actinomycosis, tuberculosis, and malignant disease) the fistula will always heal spontaneously *unless there is some degree of occlusion of the bowel on the distal side of the fistula.* This is a most important axiom.

It is quite useless, indeed it is dangerous, to attempt to cure a persistent fæcal fistula by exposing the bowel and attempting to close the opening in its wall by sutures. Such an endeavour is sure to fail. A recalcitrant fæcal fistula (with the proviso made above) is evidence of intestinal obstruction, and it is this obstruction which requires treatment by a short-circuiting operation preferably accompanied by resection of the affected segment of the bowel.

A Persistent Sinus.—Occasionally, after an operation for appendicitis, the patient is harassed by a persistent sinus. The surgeon is harassed too, because he does not know what steps to take for the patient's benefit, being reluctant to open the peritoneum in the neighbourhood of the sinus through fear of bringing about peritonitis. Clearly therefore it will be advantageous to prevent the likelihood of a persistent sinus; and there are three precautions which may be taken to achieve this end. For the main causes are: (1) the retention within the abdomen of a diseased appendix, (2) the retention of a concretion, (3) the presence of septic

and unabsorbable ligatures in the depth of the wound. The last two of these are always, or nearly always, avoidable. The first difficulty cannot always be surmounted. Nevertheless, it provides an additional stimulus to the surgeon to make an effort to find the appendix even though it lie concealed in an abscess cavity: always bearing in mind that there are circumstances in which he must forbear, and run the risk of after-trouble.

Recurrent Attacks.—A retained appendix is more likely to give rise to renewed attacks of inflammation than to cause a lasting sinus. I have operated for recurrent appendicitis in a patient who said that his appendix had been removed. But he evidently had only undergone drainage of an abscess at the earlier operation; for the appendix was still there, and its removal cured him. The case shows the care with which patients' statements are to be accepted.

Hernia of the Operation Scar.—Secondary surgical interference for the cure of a ventral hernia in the scar left by a previous operation for appendicitis is required only too frequently. And the fact is to be regarded rather as a reproach to modern surgery. Too little previsionary care is devoted to the affair. It is not necessary to leave the patient with a ventral hernia, even when he is treated for an abscess which has to be drained. And in the absence of suppuration a hernia should never result. The precautions required for the avoidance of a yielding and unsound scar are, (1) careful suturing of the fascial layers of the abdomen, (2) the use of drainage tubes of small diameter, (3) the early

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removal of these drains, (4) the avoidance of severe tympanites.

Anomalous Cases and Surprises.—Every surgeon who does much operating will now and again come upon a case which has seemed to be a straightforward case of appendicitis but which reveals, when the abdomen has been opened, some condition entirely different from that which he expected to find. The following is a sufficiently interesting example.

The patient was a Brazilian, aged eighteen. For ten days he had suffered from pain in the right iliac region of the abdomen, with pyrexia and occasional vomiting. On the day when I first saw him he had a rigor, and at the time of my visit his temperature was 99·6°, he looked ill, there was rigidity of the abdominal muscles, and a tender lump could be felt in the region of the appendix. A diagnosis of appendicular abscess was made, and later in the day he was operated upon. The appendix was found to be free and healthy, but a hard, rounded, fixed mass occupied the angle between the ileum and the ascending colon, and these portions of the gut together with the cæcum were incorporated with and inseparable from the main mass. Emerging from the tumour and following the course of the ileocolic vessels was a string of hard, enlarged glands which gradually diminished in size as they were more remote from the main swelling. I thought the tumour was malignant, and accordingly resected the lower part of the ileum, the cæcum, the ascending and part of the transverse colon together with the tumour and the glands, and anastomosed

the ileum with the remains of the transverse colon. The boy made an uninterrupted recovery from the rather formidable operation. After the performance, on dissecting the material which had been removed, the glands were found to be homogeneous in appearance, without any foci of pus, and the last two inches of the ileum were occupied by a quantity of hypertrophied lymphoid tissue. Pathological reports based on microscopical sections of the material which had been removed stated that the condition was inflammatory, and that there were no signs of malignancy or of tuberculosis. I may say that the cæcum contained numerous whip-worms and thread-worms. Perhaps they played a part in the causation of the condition.

In another instance the prominent liver associated with a pericardial effusion was mistaken for an appendix abscess, and the pericarditis was not recognised until after a useless laparotomy had been performed.

Surprises such as these may be disconcerting. Among other lesions that have been regarded as appendicitis until the abdomen has been opened have been gangrenous intussusception, carcinoma of the cæcum, suppurating mesenteric cyst, large chronic non-malignant ulcer of the ascending colon. They are mentioned merely to illustrate the fact that no one should undertake to operate upon a patient for appendicitis unless he is fully prepared for the responsibility which such a surprise may entail, and is qualified and able to deal with whatever condition he may find.

CHAPTER XIV

INTESTINAL OBSTRUCTION

Diagnosis

The diagnosis of intestinal obstruction is concerned, not alone with the recognition of a blockage of the bowel, but it includes also (1) a differentiation between partial and complete arrest of the normal progress of the intestinal contents, (2) a determination of the locality of the block, and (3) an appreciation of the nature of the lesion which is responsible for the stoppage Clearly these refinements of diagnosis are not always feasible until the abdomen has been opened Yet the endeavour to acquire an exact comprehension of the case at an earlier period than this is much to be desired And as a large proportion of the errors in treatment are attributable to the failure to observe certain important signs and symptoms, or to a lack of skill in their interpretation when they had been observed, it will be necessary to consider these signs and symptoms one by one, and to discuss the inferences that may be drawn from each

Vomiting is an almost invariable concomitant of complete obstruction of the bowel, unless its appearance is anticipated, as it sometimes can be, by the surgeon

It is copious and repeated—provided that narcotics have not been administered—and is to some extent characteristic. At first the contents of the stomach are ejected, then the vomit becomes bilious, then brown in colour, and finally it comes to have a fæcal odour. This progressive alteration in the character of the vomit is an essential aid to diagnosis, and nurses should be instructed always to preserve samples for the surgeon's inspection. It is true that when the obstruction is high up in the intestine the vomit, for reasons which are obvious, may never reach the stercoraceous stage; though as a matter of fact a blockage much more commonly occurs at a level sufficiently low down to admit of this so-called fæcal vomiting. Needless to say, the abdominal disorder should be recognised, whenever it is possible to do so, before the stercoraceous stage has been reached; and for this purpose the copiousness of the vomiting and the progressive change in character of the ejected material are sufficiently suggestive.

The time of the appearance of the vomiting is significant. For if it appears among the earliest symptoms it means either that the stoppage is high up in the bowel, or that the lesion which produces it is an acute one; for example, a strangulated hernia, as contrasted with obstructions due to stenosis of the bowel by a neoplasm. Indeed, with very early vomiting in the case of a sudden onset of obstruction in a patient who gives no history of previous discomforts, we may guess both that the blockage is of an acute nature and that it involves the small intestine.

Colic is a salient feature of a stoppage of the gut. *Indeed, recurrent griping pains may be almost the only symptoms in a case of partial obstruction.* The intermittent *spasms of pain are quite different from the constant pain of peritonitis,* although even in this there may be variations in the degree of discomfort from time to time. The griping is due to strong but ineffectual peristalsis, whereas in peritonitis, as mentioned already, peristalsis is largely inhibited.

The colic due to lead-poisoning, locomotor ataxia, renal calculus, and other extra-abdominal conditions, has to be borne in mind, but in these cases we may expect to discover definite evidences of the real cause if we look for them, while certain other details requisite to complete the picture of intestinal obstruction will be wanting.

It is noteworthy that patients who have partial *impediments in the bowel will often complain that* aperients upset them and cause them much griping pain; in consequence of which they prefer to suffer from constipation. Such a history should always arrest attention, and arouse the surgeon's suspicions.

Constipation, except when the blockage is only a partial one, as a rule is complete; and even though the obstruction be high up, the lower bowel usually is empty by the time the surgeon sees the patient, and an enema will bring away *neither fæces nor flatus. This is not* an invariable rule. In the case of a girl of sixteen years from whom I resected an irreducible intussusception of the lower end of the ileum, four successive enemas brought away constipated fæcal material. The patient

had suffered from chronic constipation, and these results misled me, for I thought that she was suffering merely from severe constipation, and consequently I let slip the opportunity for operating at a time when the intussusception might have been reduced, for I deferred operation for three days. My error was the common one of placing too much value on one or two particular features, instead of regarding the case as a whole. And I should have suffered from much heart-burning if the patient had not made a good recovery.

Although, as in this instance, a wrong impression may be conveyed by a test enema yet this should never be omitted, as it certainly gives useful evidence in the long run of cases.

In partial obstructions low down in the large bowel a history of gradually increasing constipation may be expected, and not infrequently there is an alternation of constipation and diarrhœa, while in some cases a history of diarrhœa only is obtained. In these the lesion is most commonly in the rectum. I have seen recently two patients suffering from carcinoma of the rectum, in whom the history of diarrhœa so misled their medical attendants that they failed to examine the rectum or to suspect the presence of a malignant growth for several months.

In connection with obstructions of the large intestine, it is to be noted that on questioning the patient he can often give some indication of the locality of the block. This capacity for localisation in the large bowel is totally absent from the small intestine; and useful information is to be derived from the fact.

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Tympanitic Distension of the Abdomen is merely evidence of a delay in the progress of alimentary material through the gut, and the delay may be due to causes other than obstruction—to arrest of peristalsis by peritonitis, for example—yet the sign has its significance, and we should at once doubt the presence of an obstruction in the absence of some degree of abdominal distension; while the existence of such distension accompanied but unrelieved by vigorous peristalsis, is highly suggestive of an intestinal block. The inflation of the intestines is in itself a great hindrance to any operative measures that may be required; a fact which renders it desirable apart from other reasons to recognise and to relieve the stoppage at the earliest possible moment.

Active Peristalsis is one of the leading signs by which intestinal obstruction may be differentiated from peritonitis, and the noisy abdomen of the one is in striking contrast with the silent abdomen of the other. In thin patients, and in those who have suffered for some length of time from a partial occlusion of the gut, the active peristaltic movements often can be seen, and felt by palpation; and in this event they may afford valuable aid in localising the lesion even when no lump can be felt.

A palpable lump when found is such a reliable localising sign that it should be looked for in every case; and if not discovered before, it should be sought upon the operation table by palpating the abdomen when the patient is anæsthetised and before any incision has been made. A rectal examination is, of course, essential in every case.

Among other signs that are to be noted are *tenderness and rigidity of the abdomen.* A certain degree of general tenderness and rigidity of the abdomen may be present in obstruction of the intestine, but if so they are less pronounced than in a case of peritonitis. Localised tenderness and increased muscular tension are more common and may provide useful information as to the position of the actual blockage.

The pulse and the temperature give us additional means of differentiating intestinal obstruction from peritonitis. With the former the pulse-rate is not much increased except in the terminal stages, and as a rule the pulse is soft and of full volume and is in contrast with the thready pulse of peritonitis. The temperature in obstructive cases may be raised, but as a rule to a less degree than in peritonitis.

The History is often of great value, not only in recognising the presence of obstruction, but in helping us to form some idea of the nature of the agency by which it has been brought about. With a sudden onset in the absence of any previous symptoms we may expect to find some acute lesion, such as strangulation of the bowel. On the other hand, there may be a history of recent constipation, recurrent colicky pains, or of diarrhœa, and these symptoms may assist in putting us on the trail of a correct and precise diagnosis.

Radiographic Examinations in all cases of partial obstruction are of the greatest use in showing where the impediment lies, and they should never be omitted unless the block can be localised precisely without their

aid. Moreover, they are a help in distinguishing a real impediment of the bowel, due to a circumscribed lesion, from certain other conditions which may give a somewhat similar clinical picture, such for example as tuberculous peritonitis or general *proptosis abdominis.*

Mistaken Diagnosis

The signs and symptoms of obstruction of the intestine have been outlined as above in brief detail, because it is apparent that many of the errors that are perpetrated are directly attributable to a neglect of the principles to which reference has been made.

Further, it may be that the surgeon is correct in his opinion that a certain patient is suffering from intestinal obstruction, but unless he has used every endeavour to ascertain beforehand the nature of the lesion and its whereabouts, his operation is likely to be a muddle and a bungle, instead of the work of art which it ought to be. The following case will illustrate what I mean. A man was admitted to hospital with signs of intestinal obstruction, which had developed slowly and had recently become almost but not quite complete. For some reason the surgeon thought the block was low down in the large bowel, and as the patient was rather ill and his abdomen was much distended, he performed a left inguinal colostomy. This failed to bring relief. Consequently, a median laparotomy was performed, and the lesion was found to be in the transverse colon. So a cæcostomy was performed and the abdomen was closed. The median abdominal wound became infected,

a fæcal fistula formed in this situation, and when I last saw the patient he was in a pitiable state with three intestinal fistulæ; while the original cause of the obstruction still remained untouched.

A mistake which is more difficult to avoid is to misinterpret the nature of the lesion after it has been correctly located and adequately exposed by operation. Thus a pericolitis, due to the presence of so-called "diverticulitis," is extremely apt to be mistaken for malignant disease, and this may be supposed to be too far advanced for radical measures. The only means of avoidance of such an error lies, firstly, in the knowledge that diverticulitis may produce a tumour of the bowel which bears a close resemblance to a carcinoma; and secondly, in an intimate acquaintance with the naked-eye appearance of these two pathological conditions.

I have already mentioned two cases in which chronic diarrhœa, the consequence of malignant stenosis of the rectum, failed to arouse any suspicion in the minds of the attending practitioners of the presence of an obstructing growth.

A patient who had recently begun to suffer from constipation and griping pains in the abdomen, on being questioned said that the bowel contents seemed to be arrested at one spot which he localised in the left iliac fossa. Aperient medicines always increased the griping. However, and in spite of the recommendation of the surgeon who saw the case in consultation, nothing appropriate was done until many months later, when obstruction had become complete. The patient had a

malignant growth in his sigmoid, and the opportunity for its removal had been allowed to slip by.

Treatment of Intestinal Obstruction

The purposes of the surgeon in treating a case of intestinal obstruction are twofold, namely, to remove the cause of the trouble and to drain the distended gut as quickly as possible in order to rescue the patient from the toxæmia which is threatening his life.

In certain instances these two objects may be easily and simultaneously achieved, namely, in those acute and early cases in which the diagnosis has been made and the operation undertaken at a stage when the bowel above the obstruction is not so much damaged that it cannot be relied upon to empty itself by peristalsis as soon as the impediment has been removed. These are the most satisfactory of all cases.

Familiar examples include strangulated hernias and obstruction by single and narrow bands. Less common instances are obstructions due to impacted gall-stones, enteroliths, or foreign bodies which have been swallowed. *And in connection with the last-named* type of stoppage there are two bits of advice to be given. The first is to manipulate the foreign body into a lower and more healthy portion of the bowel before making an incision for its removal. It is a mistake to cut down directly upon the foreign body where it has become lodged, except in those cases in which it cannot be moved into a lower segment; for the bowel at the point of lodgment and above this level is not to be regarded as healthy.

Secondly, when foreign bodies have become arrested at the ileo-cæcal valve, as not infrequently happens, an attempt should always be made to propel them into the cæcum, and only when this has failed should they be removed through an incision.

We now have to consider those cases in which, although the removal of the actual cause of the obstruction is a simple proceeding, yet the bowel above has become so much damaged by prolonged distension with toxic material that its peristaltic power has failed. In other words, we have to empty the distended and paralysed gut. To effect this we may incise its wall, empty out its contents, and then sew up the incision. Against this it may be urged that the paralysed gut will soon become blown up again, while our incision will have been made into damaged and unhealthy tissue; both of which objections are valid ones. And usually it is better to provide drainage in order that the intestine may be thoroughly emptied of its poisonous burden. For this purpose a rubber tube, from three-eighths to half an inch in diameter, is stitched into the bowel at a sufficient distance from the main laparotomy wound, and is brought out through a stab wound in the abdominal wall, care being exercised during the after treatment to avoid infection of the main wound by the discharges from the artificial fistula. There are objections, of course, and every surgeon will be aware of them, to the establishment of fistulæ connected with the small intestine. But we are now dealing with a type of case that is fraught with dangers and difficulties solely because a

timely diagnosis has not been made, and this has plunged us into a bog from which there is no path of escape over firm ground. We are bound to flounder a bit in our efforts to emerge. Moreover, the majority of these procrastinated diagnoses concern obstructions lowdown in the bowel and especially in the large intestine, and are attributable to the long latent period and the slow development of unmistakable symptoms which are features of these low obstructions; consequently, the drainage which is recommended here will more often involve the cæcum than the small gut, and the objections that can be raised against opening the cæcum are not weighty ones.

Often it happens that the impediment to the bowel is of such a nature that to effect a remedy it will be necessary to resect a portion of the intestine, and the surgeon has to decide whether he will perform (1) resection and immediate anastomosis without drainage, (2) resection and immediate anastomosis with drainage, (3) resection and drainage without immediate anastomosis, (4) drainage alone, (5) anastomosis alone, resection being deferred—that is to say, a short-circuiting operation with a view to subsequent resection.

(1) The cases of obstruction which are suitable for immediate resection and anastomosis without drainage are for the most part partial obstructions, and in addition those acute cases of complete blockage in which the small intestine is implicated. But there is this advice to be given, namely, to resect as much of the distended bowel above the blockage as appears

to have been damaged. It would be insufficient merely to remove the gangrenous portion of gut, in a case of neglected strangulated hernia, for example. The injured and stretched gut for some distance above this level must be removed in addition.

(2) Many cases of complete obstruction in the large intestine are amenable to immediate resection and anastomosis provided that drainage is secured. For example, a neoplasm is found in the transverse colon. Provided that the patient's general condition be not too bad, a radical operation may be performed, with anastomosis of the divided gut, the cæcum being drained by a rubber tube in the manner that has been suggested already. This is preferable as a rule to performing (3) a resection and draining the gut by means of a tube tied into its open extremity, because in the latter method a second operation will be required to close the artificial anus, and it may be difficult to obtain a satisfactory result. It would be preferable—if there are reasons for not carrying out a resection with immediate union of the divided ends of the gut—to be content with (4) a cæcostomy at first, the radical operation being deferred until the general and local conditions have sufficiently improved.

The special points to be remembered are, firstly, that it is essential to provide means by which the distended gut may be quickly emptied of its contents, and that, if the obstruction has been so long present that the damaged gut cannot effect this by its own peristalsis, then drainage of the bowel is essential. Secondly, it

is to be borne in mind that the distended intestine for a variable distance above a block is not healthy, and is unsatisfactory tissue from the surgical standpoint.

(5) Short-circuiting operations unaccompanied by resection so far have not been mentioned, because as a rule they are not satisfactory measures for the relief of obstruction. They leave a bag of bowel behind which is filled up with highly toxic material, and they therefore do not properly fulfil the purposes which the surgeon must keep in view.

Difficulties and Errors in Intestinal Anastomosis

Lateral Junctions, as a rule, are much to be preferred to end-to-end union, and the latter should be reserved entirely for the experts, and even in their hands is likely to have inferior results. In the first place, it is difficult to perform, and subsequent leakage is more common than with a lateral anastomosis. Moreover, in every case of end-to-end union some degree of *stenosis* of the gut will follow. To avoid this narrowing is quite impossible, although it is not invariably sufficient to cause subsequent trouble; whereas I have followed up cases of lateral anastomosis both of the large and of the small intestine for many years and the patients have remained free from any signs of partial obstruction or other untoward symptoms.

When a lateral anastomosis has been properly formed there is practically no tendency to any *leakage* at the line of junction, but there is a danger of leakage at the cut end of the bowel, where resection has been performed.

For this reason each cut end should be closed first with a circular running suture, then the end is invertedin to the lumen, and two successive rows of continuous Lembert suture are inserted. This renders any possibility of leakage quite remote. Care is to be taken to make the lateral anastomosis sufficiently long to avoid subsequent stenosis, and for this the incisions in the gut should be about 2¼ or 2½ inches long. And the actual anastomosis ought to be effected as closely as possible to the ends of the divided gut, so as to avoid leaving blind terminal sacs in which fæcal matter may accumulate.

A minor detail that may be mentioned in connection with intestinal resections is the desirability of placing the clamps upon the bowel at a sufficient distance from the line of section, to allow a large enough amount of slack being left so that the cut ends may be closed by suture before the clamps are removed.

It is necessary, of course, in all cases to close the hole in the mesentery on completing the anastomosis after a resection. If this be not done there is a real danger of coils of intestine passing through the aperture, with the consequence of intestinal obstruction.

Artificial Anus and Colostomy

When a fistulous opening is about to be made into the bowel in order to effect drainage, the operator must be clear in his mind as to whether the aperture is to be merely a temporary one or whether the nature of the case demands the formation of a permanent artificial anus. In the former case he will be careful not to withdraw

CHAPTER XV

OPERATIONS ON THE STOMACH

A CLEAR mind is the special and characteristic feature of the successful surgeon. A wide space, however, divides the clear mind from the simple mind. A study of the modern history of gastric surgery reveals the fact that simple-minded surgeons are in pretty good supply. For the list of errors committed in connection with the surgery of the stomach is surprising, not only because of its length, but on account also of the crudity of the mistakes. A great proportion of these are attributable to the performance of a gastro-enterostomy for the relief of vomiting or other symptoms without sufficient consideration of the special circumstances of the case. And as the well-known writer of naval history, Admiral A. T. Mahan, U.S.N., has remarked, few facts are unconditioned, unrelated to other facts, without due consideration of which they themselves cease to be facts and become pure fancies. Now it is true enough that persistent vomiting can be cured by a skilful gastro-enterostomy—in certain circumstances. Action taken in accordance with this fact, but omitting to consider sufficiently the conditioning circumstances, has been the cause of the largest number of major errors in gastric surgery.

Thus it has come about that patients with vomiting due to uræmia, lead colic, locomotor ataxia, cerebral tumour, thoracic aneurism, early pregnancy, chronic appendicitis, cholecystitis, acidosis, Ménière's disease, phthisis, stricture of the urethra, hysteria, and even from sickness induced by pushing the fingers into the pharynx, have been supposed to suffer from gastric disorder, and in many instances have had gastro-enterostomy performed.

After all, there are but two lesions of the stomach that can be regarded as absolute indications for gastro-jejunostomy, namely, gastric obstruction and duodenal ulcer. The purpose of the operation clearly is to enable the contents of the stomach to pass directly into the jejunum, either because they are hindered from travelling by the usual route owing to some obstacle, or because it is desirable to prevent them from traversing the duodenum on account of the presence of an ulcer in this situation.

Pyloric obstruction will cause pain, dilatation of the stomach, vomiting, and emaciation; and if any one of these is absent special caution should be exercised before recommending an operation. Obviously, a general overhaul of the patient is essential in all cases; but even when there is strong evidence of a gastric lesion we still cannot afford to neglect any clinical methods that may throw light on the case, and among these are radiographic examinations after a barium meal, and investigation of the stomach contents. The former are essential, while the latter, though perhaps less instructive,

cannot be omitted with safety. The presence of free hydrochloric acid in excess, for example, though not a proof, yet is strongly suggestive of the existence of a non-malignant ulcer. And unless we have obtained information on this point beforehand we may find ourselves at a loss when the stomach has been exposed. On the one hand, we may subject the patient to a hazardous gastrectomy when he has a simple ulcer which could be more securely treated by other means; on the other, we may hesitate to perform a gastrectomy when he has early malignant disease.

At the best the surgeon can but guess at the precise diagnosis. He is almost certain to guess wrongly if he does not take the trouble to acquire all the ascertainable facts.

Much of the shortcoming of modern surgery is due to the neglect of team-work. The surgeon wants to do too much himself; whereas for the good of any patient the loyal and active co-operation of a group of individuals is required. The physician, pathologist, radiographer, anæsthetist, assistant must all be upon the stage, even if the surgeon does claim the leading part and the limelight.

A useful purpose may be served by mentioning just one example of the misinterpretation of an individual symptom.

Vomiting.—The characteristic features of vomiting due to pyloric obstruction are that it is copious and occasional. When a patient is sick several times a day, or when in a case of persistent vomiting the quantity

ejected on each occasion is small, one would be surprised to find obstruction of the pylorus. The following case illustrates the danger of ignoring these points, and further illustrates what may happen if patients are recommended to undergo operations without proper clinical examination beforehand. A patient sought my advice on account of persistent vomiting. Six weeks previously he had been submitted to gastro-enterostomy, from which he had derived no benefit. On being questioned he stated that the vomiting took place during or soon after a meal, and it consisted of the return of a few mouthfuls of the food which he had just swallowed. The vomit did not burn his throat. Examination of his chest revealed a large and obvious thoracic aneurism. The so-called vomiting was merely regurgitation of food from his œsophagus.

Many other examples of mistakes having the same radical causes as the above might be quoted, but their recital would be prolix and would serve no useful purpose.

Hæmatemesis.—It is of course a well-recognised fact that hæmatemesis may be brought about by many conditions other than ulceration of the duodenal or gastric mucosa—cirrhosis of the liver and the gastrorrhagia of women being notable examples. I have seen the hæmatemesis of splenic anæmia lead to a diagnosis of duodenal ulceration, and the clue to the symptom was discovered only when the abdomen had been opened for the purpose of performing a gastro-jejunostomy. The fact is that vomiting of blood, so

far from being evidence of a surgical ulcer, is in itself suggestive that some other condition is present.

Epigastric Tenderness.—Little or no stress need be laid upon the presence of tenderness in the epigastrium as evidence of a local lesion. In any case of which vomiting is a feature the epigastrium may be tender—in uræmia, acidosis, and the sickness of early pregnancy, of phthisis and other disorders.

Dyspepsia.—Indigestion, like epigastric tenderness, has but the slightest value as an indication of a primary lesion of the stomach, for it may be caused by phthisis, heart disease, spinal caries, nephritis, anæmia, mental strain, deficient mastication of food, to mention a few examples. The statement seems almost fatuous when perused, and yet the failure to appreciate its truth has led to a continual succession of misfortunes.

The patient complains of dyspepsia, the tired overworked doctor gives him bismuth, and does not always find time even to ascertain the condition of his teeth. The patient finds his way to hospital and is advised to have a gastro-enterostomy performed. And I suppose it always will be so as long as doctors are given too much to do and patients are complaisant.

Lest the morals of my preceding remarks may be concealed by the detail they may as well be restated now. The first one is this: that it is unrighteous to recommend a patient to undergo laparotomy for the cure of dyspepsia and vomiting without a careful and deliberate reconnaissance of every conditioning circumstance. The second is that the only lesion which is indisputably

amenable both to recognition and to cure by gastro-enterostomy is pyloric obstruction. Sometimes, it is true, duodenal ulcer may be properly treated by a short-circuiting operation, but the lesion is difficult to diagnose, and much consideration should be given to every feature of the case before such an operation is recommended as a curative measure.

Gastro-enterostomy

The relative advantages of a posterior and an anterior gastro-enterostomy are no longer common subjects of debate, and it has become the ruling fashion among surgeons to choose the posterior operation I say fashion because I am not aware of any unquestionable facts which prove a superiority of the posterior over the anterior site for the junction. Opinions there are in plenty, but, as we all know, the best established opinions can offer but poor resistance to a fact which is moving in the contrary direction. This is certain, that whether the jejunum be anastomosed with the front or with the back of the stomach, a good result may be expected provided that the technique is correct and the case is a suitable one.

There are certain accidents and calamities which have occurred during the course of gastro-enterostomy or subsequently which owe their origin to technical errors. To some of these attention may be called, because, as they have happened once, they may happen again. The first slip of this kind that rises to my mind is the accidental suture to the stomach of some

other portion of the bowel than the jejunum. I once made a post-mortem examination of a man upon whom a gastro-enterostomy had been performed shortly before his death. The operation had been carried out with speed, and, in fact, with a show of brilliance. It was followed, however, by true fæcal vomiting—which is a more miserable kind of sickness than that described as stercoraceous—and the patient was so distressed that he cut his throat with a pen-knife and died. And it was found that the lower end of the ileum instead of the upper end of the jejunum had been anastomosed with the stomach. The surgeon, desirous of working expeditiously, had seized what he thought to be jejunum, pulled upon it until he found the bowel taut and the mesentery short, and thus mistook the lower end of the ileum for the upper end of the jejunum.

A less unhappy error is to mistake a lax and movable duodenum for the jejunum. A friend asked me to see in consultation with him a patient upon whom gastro-enterostomy had been performed a few days previously. The operation had been followed by persistent vomiting, and the patient's position was becoming desperate. We decided that a second laparotomy gave the only hope. This was carried out, and it was found that the duodenum, which was unduly movable, had been mistaken for the jejunum and anastomosed with the stomach, and that kinking had ensued at the duodeno jejunal flexure. A duodeno-jejunal anastomosis was effected and the patient made a good recovery.

A more common mistake is to suture the jejunum to

the stomach in such a way that the exit of the gastric contents is prevented by kinking of the bowel at the site of the anastomosis. By making the incision in the stomach nearly vertical and by arranging that the distal portion of the jejunum shall emerge from the lower part of the anastomotic area kinks usually will be avoided. If, on inspection after the anastomosis is completed, it looks as though there will be obstruction due to kinking, one or two anchor sutures should be inserted so as to open out the fold.

I have always been expecting to hear of a case in which after a posterior gastro-enterostomy obstruction has followed from an upside-down anastomosis. The accident seems to me to be a likely one to happen in the hands of a novice who for the first time does a posterior no-loop anastomosis between the stomach and jejunum.

Unless forethought is made, it is quite easy to miscalculate the area of stomach wall available, and to find as the suturing progresses that a portion of the stomach to which the peritoneal coat is but loosely attached, namely, that portion from which the gastrocolic omentum springs, has to be included. In such a case there appears to be an added risk of unsatisfactory union and leakage. Another possible cause of an imperfect and leaky union is brought about as follows: The first line of the continuous peritoneal suture having been inserted and the stomach and jejunum having been laid open, the surgeon in completing the continuous through and through suture inadvertently fails to secure

the cut edge of the peritoneal coat in one or more places. This mishap is quite easy because the peritoneal coat is more elastic than the mucous coat, and retracts so far that the surgeon, unless he is on guard, may fail to pick it up with the suture, a lapse which is the more likely because of the effusion of blood from the cut surfaces, which helps to obscure the details of the wound.

This hæmorrhage requires a comment because it sometimes costs the patient his life or necessitates opening up the wound in order that the bleeding vessel may be secured. Usually the through and through continuous suture is sufficient to check the hæmorrhage, but not always, and a wary eye should be used to discover vessels which bleed in spite of the running suture, and any such vessels found should be ligated if the bleeding is of a volume which cannot be regarded as negligible And in this connection it should be remembered that any retching which is indulged in during recovery from the anæsthetic will produce congestion of the viscera and so conduce to hæmorrhage from any imperfectly secured blood-vessels which have been divided. I have witnessed a case in which such persistent hæmorrhage ensued that a second operation was rendered necessary in order to secure the bleeding vessel.

The aperture in the transverse mesocolon which is made in the course of a posterior gastro-enterostomy should be united to the peritoneum of the stomach by means of a few sutures, in order to prevent prolapse of bowel through the opening with consequent risk of

strangulation. When making this opening at the commencement of the operation care will have been exercised, of course, *to avoid wounding any large vessels.*

Strangulation of intestine is said to have followed anterior gastro-enterostomy owing to the passage of a portion of intestine over the loop of the jejunum, probably owing to the loop being too long. Too short a loop is said to have caused blockage of the transverse colon. But I have no detailed information on these accidents.

Ulceration of the jejunum, in some instances leading to hæmorrhage and perforation, is one of the most troublesome sequels of gastro-enterostomy. One or other of certain contributary causes may be held responsible. The first is a partial obstruction at the site of the anastomosis. Others have been mentioned in an instructive paper by G. Wright.[1] Among these are—

(1) Imperfect neutralisation of the gastric juice by pancreatic secretion. This defect he regards as greatly facilitated by a "long-loop" operation, and also by a secondary duodeno-jejunostomy.

(2) The use of non-absorbable suture material.

(3) Sepsis.

He recommends the following measures of prophylaxis: The performance of a "no-loop" operation with a wide opening; the use of absorbable sutures and ligatures throughout the operation; the maintenance of gastric asepsis. And he further advises that after the anastomosis has been completed the colic omentum

[1] *Brit. Jour. Surg.*, 1919, Vol. I. p. 390.

should be sutured to the stomach wide of the anastomosis so as to facilitate subsequent operation in the event of secondary ulceration taking place.

There is another fact that should be appreciated in connection with gastro-enterostomy and it is this: that when the operation is done in the absence of obstruction the pylorus should be artificially closed if the full benefit is to be secured. For if this closure be not carried out, the stomach contents—or a considerable proportion of them—will continue to pass through the pylorus and duodenum, in spite of the artificial aperture into the jejunum; in other words, we shall have failed to short-circuit the stomach contents.

Furthermore, if the pylorus be permeable the opening between the stomach and jejunum will contract and in course of time may close completely, because, as explained elsewhere, intestinal fistulæ always tend to spontaneous closure unless there is obstruction—partial or complete—of the bowel at a point distal to the fistula.

Perforated Gastric Ulcer

Concerning the treatment of a perforated gastric ulcer there are a few comments which it seems worth the while to make. When the abdomen has been opened and the perforation has been exposed, the obvious thing to do is to close it with sutures. The surgeon's endeavour should be, whenever it is feasible to do so, to invert into the stomach the whole of the ulcer and to suture the stomach wall in such a way that this inversion is maintained *A common mistake is to place a*

purse-string suture close around the actual perforation. Then on attempting to tighten the suture, instead of closing the aperture the stitches merely cut out, because the indurated portion of the stomach wall does not yield easily, while the inflamed peritoneum lying over it is soft. The correct procedure is to ascertain with the finger the area of induration and if possible to place the purse-string suture wide of this area.

Occasionally, owing to its inaccessibility or for some other reason, the perforation cannot be closed. In such an event, a drainage tube should be fixed in position near the ulcer. Twice I have had to resort to this measure, and the patients made good recoveries in both instances. Care has to be taken, of course, to prevent the escaping gastric juice from causing ulceration of the skin in the neighbourhood of the fistula; this can be done by keeping it well coated with sterile vaseline. The point is this—that, unless he knows about the efficiency of drainage, the surgeon may feel that it is absolutely essential to close the perforation in order to save the patient's life, and he may be induced to spend so much time and energy in the hopeless endeavour as to produce fatal shock.

Sometimes perforations take place in the posterior wall of the sac and cause a good deal of difficulty in diagnosis. I have seen a case in which a large, chronic ulcer involving the lesser curvature of the stomach had perforated the anterior wall of the viscus close to the attachment of the gastro-hepatic omentum. The surgeon in charge of the case closed the aperture; but

the patient died At the post-mortem examination it was found that the ulcer extended on to the posterior wall of the stomach, which also was perforated, into the lesser sac.

A short while ago, whilst operating upon a patient who had a perforated gastric ulcer, I was asked by the house surgeon whether I made a practice of performing gastro-enterostomy after closing the ulcer. The question was a pertinent one and aroused in me much meditation, for I wondered if it was the usual practice of any surgeon It is true that one has done a gastro-jejunostomy when operating for perforated gastric ulcer, but only because there were definite indications that this procedure was required, that is to say, pyloric obstruction was present while the patient was in a sufficiently good condition to withstand the necessary prolongation of the surgical interference. *Such cases are exceptional.* In the absence of gastric obstruction I regard a gastro-enterostomy in these cases as malpraxis I have seen a surgeon close a perforated ulcer in an early and what seemed to be favourable case; he then did a gastro-enterostomy though there did not seem to be the least indication for it. The patient died.

CHAPTER XVI

INTUSSUSCEPTION IN BABIES

When it occurs in the typical form, intussusception is easily diagnosed. The patient is a healthy, breast-fed baby, less than two years old; the onset of symptoms is sudden, the paroxysms of pain are intermittent, there is a passage of blood and mucus from the anus, and a lump can be felt in the abdomen. It is true that intussusception may come about at any age, and that in older patients there may be a gradual onset with absence of every one of the conditions mentioned above except perhaps the palpable lump. The recognition of such cases may be considered as having been dealt with sufficiently in the chapter on Intestinal Obstruction. And in connection with the diagnosis of acute intussusception in babies it will be sufficient to utter the warning that if the patient has been ailing previously to the attack; if he is unhealthy in appearance; over two years of age; if there is no passage of blood and mucus from the bowel, or if no lump can be felt with bimanual examination aided by anæsthesia, then we should indeed be cautious before attributing the symptoms to the presence of intussusception.

A couple of examples will suffice. I was asked to

operate upon a child of three and a half years on account of a supposed intussusception. The child looked feeble, the abdominal symptoms had come on gradually, no blood or mucus had been passing from the anus. There was a sausage-shaped tumour in the abdomen which was responsible for the erroneous diagnosis. The child had abdominal tuberculosis.

In another case I was sent for by the house surgeon to operate upon a baby who was thought to have an intussusception. The symptoms were suggestive of this condition. Inspection of the child's napkins, however, raised doubts, for though blood and mucus were present they were in small quantity, and the mixture was brighter and cleaner looking than the efflux from an intussusception. Further inspection showed that the child was suffering from a unilateral prolapse of the anal mucous membrane, replacement of which effected a relief from all unpleasant symptoms.

Some mistakes in diagnosis are inevitable. At a sectional meeting of the Royal Society of Medicine in November 1913, Philip Turner showed a child who had been operated upon when four months old for a supposed intussusception. The signs included the passage of blood by the bowel and the presence of a small movable lump just below and to the right of the umbilicus. The lump proved to be an inclusion cyst situated in the mesentery in the angle between the ileum and the colon. In the circumstances a mistaken diagnosis could not be avoided.

An occasional source of great difficulty is purpura

of the type commonly associated with the name of Henoch. For here we may have colicky pains in the abdomen, vomiting, tenesmus, the passage of blood by the bowel, and even a palpable lump.[1] Moreover, these symptoms may precede the appearance of a cutaneous rash. The focal lesion is a hæmorrhage into the wall of the intestine, the lower end of the ileum being the part most commonly affected. If the patient be within the limits of age of an acute intussusception, and in the absence of any cutaneous petechiæ it is especially difficult to differentiate this condition from intussusception. No palpable lump, it is true, accompanies the symptoms, as a rule, when these are due to Henoch's purpura, and in the rare instances in which a lump is present it may be expected to lack the characteristic sausage-shape and varying consistence of an intussusception; but it is seldom wise to rest our judgment and the baby's safety upon the presence or absence of a single sign. In these difficult cases we must do the best we can to make a correct diagnosis by observation of the case as a whole. Sometimes a careful search will reveal a purpura that was not manifest at first. Special inspection should be made for this purpose of the backs of the elbows, the buttocks and scapular regions, the fronts of the knees, and the skin over each tendo-Achillis. A rash may be present in these situations when it is not to be found elsewhere. But one must not be led away by the idea that because purpura is present therefore there can be no invagination of the bowel. There is

[1] D. FitzWilliams, *Rep. Soc. Study Dis. Child*, Vol. VIII, p. 320.

indeed evidence [1] that the effusion of blood into the wall of the ileum may be the direct cause of such an invagination. Nevertheless, the existence of a disordered state of the blood as shown by purpura is bound to call for the utmost caution before any laparotomy is undertaken.

Treatment

There is but *one sound method of treating an intussusception*, and that is to open the abdomen and reduce the invagination. Now and then an advocate of reduction by rectal injection has his say, but even if we admit that the method occasionally is successful, we must acknowledge that it is attended with considerable danger. The hardest part of an intussusception to reduce is the part that first became invaginated. It is useless to *reduce all the remainder if this is left unreduced*. Nor can we tell if and when complete reduction has been brought about by rectal injection. Huber [2] has stated *that in a number of successful cases of his own a passage of fæces has invariably followed the relief of the obstruction*. This, however, cannot be relied upon as a guide. J. L. Falconer [3] has related a case in which, under hydrostatic treatment, the lump disappeared, fæces came away, the passage of blood ceased, and a normal stool was passed. None the less the child died with an unreduced and sloughing intussusception.

[1] H. Lett, *Rep. Soc. Study Dis. Child*, Vol. VIII. 1908, p. 307.
[2] *Arch. Ped.*, 1902, p. 421.
[3] *Lancet*, 1906, Vol. II. p 652.

But little significance is to be attached to disappearance of the tumour under hydrostatic treatment, for the residual invagination—which is the key to the whole condition—may be so small after the main mass has been reduced, as to escape detection by the hand. W. Templeton [1] has put on record an instance in which the disappearance of the tumour as the result of hydrostatic treatment led to an erroneous supposition that complete reduction had been brought about.

Nevertheless, it may be well that rectal injection has its use as ancillary to operation; for if the main part of the invagination be reduced before the abdomen is opened, subsequent manipulations within the abdomen will be facilitated and expedited. Some degree of "spontaneous" reduction appears to be common in cases submitted to operation, even when no preliminary injection has been used. Possibly it is due to a reflex peristalsis brought about by digital examination of the rectum.

With regard to laparotomy in these cases, every care must be taken to keep the baby warm, and to waste not a moment of time during the operation. One of the chief difficulties is a distended abdomen. For if any portion of the bowel escape from the wound it may be most difficult to replace and much precious time may be lost in trying to get it back and in sewing up the wound. To avoid such escape a small incision is desirable, in fact, the smallest which will allow the surgeon to unravel the bowel; and the assistant should be warned

[1] *Brit. Med. Jour.*, Aug. 3, 1907, p. 262.

and no advice can be given here as to the avoidance of such recurrence. But more common than a repetition of the invagination is a renewal or continuance of the symptoms including the passage of blood and mucus. It is important that these symptoms should not be misregarded as indicating a recurrent intussusception. Unless there has been a clear interval of health it is wiser to assume that no further operation is required. If the doubts are very great, the abdomen should be examined with the infant under anæsthesia, in order that the presence or absence of a palpable and characteristic lump may be recognised or excluded.

When an operation is performed upon a child of more advanced years or upon an adult, and an intussusception is discovered, it is not sufficient merely to reduce the invagination. The cause of the condition should be sought and if possible removed. Not infrequently this will be found to be a papilloma or some other tangible agent, to overlook which would be an error fraught with evil consequences.

CHAPTER XVII

HERNIA

Diagnosis

The first stage in the development of an acquired hernia is the bulging of the parietal peritoneum through an aperture or weak spot in the abdominal wall. This preliminary process may be accompanied by a good deal of pain, even though so little advance has been made that no palpable or visible sign of a hernia can be detected. The chief feature of the pain is that it is brought on by exercise, being relieved by rest.

Now, it is important to appreciate the significance of this pain, or we may be led to infer that it is neurotic in origin or we may open the patient's abdomen on the supposition that the symptom may be attributable to appendicitis, ovaritis, or some other remediable abnormality other than the real one. Such failures of diagnosis are the more regrettable because by giving the patient exercises to strengthen the flexors and adductors of his hip and the abdominal muscles, we may not only relieve the pain but may prevent or postpone the appearance of the rupture.

Even established hernias may be overlooked by the surgeon, especially if he examines the patient only in the recumbent posture.

Congenital hernias which only occasionally " come

down," and which are empty at the time of examination, are especially apt to give difficulty So too are small femoral hernias in fat women I have known a strangulated Richter's *hernia in the femoral region* so obscured by fat that only the most careful palpation *could detect any swelling, and even then the diagnosis* remained in doubt until the lesion was exposed by the knife I suppose that sometimes hernias are overlooked owing to reticence on the part of the patients One night I was asked to see a lady who had acute intestinal obstruction Preliminary inspection and palpation yielded no information as to the locality of the obstruction But further investigation revealed a strangulated femoral hernia I asked why she had not told us at *once about the lump* "Oh," *she replied,* "I was afraid you might say it was a strangulated hernia, and *that I should have to be operated on!*" *Indeed, in one* instance I have known disaster to come about through lack of enterprise on the part of the doctor and want of candour in the patient The weather was hot and the patient's vomiting was diagnosed as "summer sickness" and was treated with a bottle of medicine Later on the patient was admitted to hospital with a strangulated femoral hernia containing gangrenous intestine

Interstitial hernias are especially liable to escape observation owing to the fact that they do not produce an obvious lump detectable by casual inspection The knowledge that this form of hernia is most commonly associated with an undescended testicle is helpful Moreover, an interstitial hernia rarely, if ever, arises

de novo. If it is not the mere accompaniment of an undescended testicle, it usually is a secondary development in an old hernia, being the product of an ill-fitting truss or of vigorous taxis.

Obturator and retroperitoneal ruptures are seldom to be diagnosed without the assistance of a laparotomy.

With regard to mistaken diagnoses, perhaps the commonest is to regard an inflamed lymphatic gland in the groin as a strangulated hernia. Not much harm will accrue from this, provided that the surgeon does not forget to investigate the cause of the glandular enlargement which the operation has brought to light.

Hydroceles often are mistaken for hernias, and hernias for hydroceles. In addition to the ordinary manipulative methods for the differentiation of these two conditions, the test of translucency should be applied in all cases of doubt, and many errors would be avoided thereby. Mention is made on another page of a case in which a trocar was plunged into a large scrotal hernia, in the belief that it was a hydrocele; and I dare say the error has been made fairly often. Hydroceles of the cord also are occasional sources of difficulty.

Psoas abscess I have seen regarded as a hernia. The abscess was pointing below the outer half of Poupart's ligament. There was an obvious impulse on coughing and the lump was reducible, and doubtless these two features were responsible for the error. As a matter of fact, the situation of the lump and its warmth should have made clear its nature at once, the spinal rigidity being a confirmatory sign.

Torsion of an undescended testicle may be indistinguishable from a strangulated hernia

Taxis

In these days of somewhat unrestrained and passionate surgery too little attention perhaps is given to the subject of reduction of strangulated hernias by taxis Still, there are occasions when it is desirable to avoid an operation The patient may have diabetes or some other malady which contra indicates or prohibits the employment of the knife Therefore it is necessary to appreciate some of the causes which contribute to failure in attempts to reduce these ruptures by manipulation

The first thing to be done is to try to reduce the hernia But this preliminary attempt should only be of the gentlest kind, because prolonged and vigorous manipulations will cause bruising and swelling of the structures which are involved Preliminary taxis having failed, the patient should be kept in the supine position with the foot of the bed raised, and cold water dressings or an ice-bag applied to the rupture Then, when this treatment has been used for half an hour or an hour, a second and more determined effort should be made to replace the bowel within the abdomen The beneficent part played by the supine posture alone is shown by the following case A man was admitted to hospital with a strangulated hernia which had defied attempts at reduction by taxis applied by his own doctor and also by the house surgeon When, however, he was on the

operation table and the groin was laid bare, the hernia was found to have become spontaneously reduced. Such an experience is quite a common one in dealing with strangulated hernias in children.

With regard to the actual method of taxis, this will consist of two distinct manœuvres. The first one is to endeavour to empty the strangulated intestine of its contents by gentle continuous pressure. When the bulk of the swelling has been diminished in this manner, then, and not till then, should the attempt be made to effect reposition of the hernial contents within the abdomen. The idea underlying the manipulations necessary for this purpose is to reduce the bowel not all at once, because this is almost sure to be impossible, but by gradual degrees, the first portion to be reduced being the portion that has descended last into the sac. Consequently, the pressure will be applied not to the fundus but to the neck of the sac, and throughout it is necessary to visualise the hernial canal so that pressure shall be applied in the proper directions.

Complications following Reduction by Taxis.—Persistence of symptoms after an apparently successful reduction by taxis is not such a common event as it used to be in the days when much force was habitually and necessarily used upon hernias which proved stubborn. Nowadays taxis is used so gently and operations are so readily undertaken that complications due to rough handling are rare. Still, it may be advantageous to recall some of the unpleasant sequels.

The most likely mishap in these days probably is

the strangulation of bowel by omentum. In replacing the bowel it has been made to pass between two points where the omentum is adherent to the neck of the sac, and so has become obstructed or strangulated. Another cause of persistence of symptoms of intestinal obstruction following an apparently successful reduction comes about in old-standing, large-obstructed hernias. In these ruptures adhesions are apt to form between contiguous portions of the bowel within the sac. The kinking and relative immobility of the gut caused in this way may be responsible for the symptoms which have brought the patient under observation, and it is no matter of surprise, therefore, if no relief is effected by a mere transference of the kinked and adherent bowel from the sac of the hernia into the abdomen.

Reduction of the hernial contents into an interstitial sac or into the inner compartment of an hour-glass sac—the point of strangulation being at the abdominal opening—is sometimes brought about. In these cases the surgeon who has performed taxis is apt to miss the satisfactory gurgle and the complete and sudden subsidence of the tumour which is the common accompaniment of genuine reduction, and he probably will have a suspicion that his handiwork in some way or another has not been completely successful.

Reduction *en masse,* rupture of the hernial sac or of the bowel itself, reduction of gangrenous or perforated intestine, though conceivably possible, are yet most improbable accidents at the present day.

Sometimes it happens that after the reduction of a

hernia which has been strangulated, the patient suffers from diarrhœa, with passage of mucus and perhaps blood. This is attributable to a localised enteritis caused by the injury to the segment of bowel which was involved in the rupture. In some of these cases the patient has subsequently suffered from colicky pains in the abdomen, which have gradually become more severe and culminated in intestinal obstruction. In these cases the bowel has been so injured that it has been unable to recover its function, and is either bound down by adhesions or is the seat of hypertrophic fibrosis.

There is one other possibility that has to be considered when reduction of a hernia fails to relieve the symptoms, and this is that some other cause than the hernia is responsible. A patient was operated upon on account of symptoms which were supposed to be due to a large irreducible and apparently obstructed scrotal hernia. The operation did not bring relief. A median laparotomy was performed, and a carcinoma of the large intestine producing a blockage of the gut was discovered.

Trusses

In most instances the wearing of a truss is merely a palliative measure; but in certain cases of infants and young children with inguinal hernias there is some hope of effecting a cure of the condition if the appliance is properly handled. In these cases there is a congenital sac the obliteration of which will cure the rupture, and it may be hoped with good reason to effect a permanent closure of the peritoneal tube by the application of con-

stant pressure from without. But for this achievement incessant attention is required. The aim must be to prevent absolutely the abdominal contents from bulging into the sac on any single occasion. For it must be clear that intermittent stretching of the abdominal aperture by the forcible entry of bowel or omentum will frustrate our efforts to bring about a permanent closure. Consequently, the child must wear the truss at all times—by night as well as by day. Two trusses will be required, so that when one is being washed the other can be applied. The instruments should be covered with rubber or celluloid so that they can be kept clean, and they should not be removed while the infant is being bathed. It is, of course, essential to dry the skin underneath the truss and to powder it well after the bath. When for any reason the truss has to be taken off the infant should be laid upon his back and a finger placed on his abdomen exactly underneath the pad, firm pressure being maintained on this spot until the same truss or another one has been adjusted. Wool trusses are mere placebos. The truss must exert sufficient pressure and must fit properly. Constant and conscientious endeavour in these cases never to allow the abdominal viscera to enter the hernial sac is the essence of successful treatment by trusses.

To some extent the foregoing remarks are applicable also to the ordinary palliative treatment of hernia in adult life by trusses. The natural tendency of a hernia is to grow larger. Every time a portion of intestine or omentum comes down it stretches the abdominal opening

and distends the sac, until the opening is so large and the tissues around the sac are so stretched and flaccid that of themselves they offer little or no resistance to the protrusions from the abdomen. The whole responsibility for control of the rupture then falls upon the truss. In course of years, the hernia enlarging and the truss remaining stationary in size, a time will inevitably come when the pad is insufficient to keep back the hernia. The desirability, therefore, of more earnest and detailed attention than this matter commonly receives is manifest. A man cannot be expected to wear a heavy truss by day and by night. But he can have two trusses, the lighter one being worn when in bed. And every patient should be warned of the necessity of particular care whenever he is suffering from a cough. In other words, the surgeon has not completed his duty when he has advised the patient to wear a truss. He must himself ascertain that the appliance is properly fitted and that it is efficient; he must explain its purposes and the natural history of the rupture to the patient, and in co-operation with him must realise that the combat against the disorder will continue for the rest of the patient's life.

If a truss causes pain it is almost certain that the instrument fits badly or is unsuitable for the case. Possibly the hernia is not completely reducible, and the pad consequently presses upon a piece of adherent omentum. Or, in the case of an inguinal hernia, the pad perhaps rests upon the pubic bone. In the latter case not only will pain and discomfort be caused, but the instrument almost certainly will fail to control

these cases it is essential for success, not only to tie and remove the sac, but also to narrow the abdominal rings, and by suturing the conjoined tendon of the transversalis and internal oblique muscles to Poupart's ligament to re-establish the posterior wall of the inguinal canal so that the valvular resistance to extrusion of peritoneum may be restored.

As concerns the after-treatment, it is essential that the patient should be kept to his bed for three weeks following the operation, and absolutely forbidden strong muscular exertion for three weeks more. If he is engaged in work which entails much physical effort he should be deterred from it until at least eight weeks have elapsed from the time of the operation. I am aware that such caution is not considered necessary by some surgeons. However, my own observations convince me that in some instances definite harm has resulted from too early a resumption of activity. I have seen a young, healthy-looking man with a recurrence of hernia three months after a so-called radical cure. He had been allowed out of bed on the sixth day after operation, and on the seventh day travelled from the south of England to his home in Lancashire as an ordinary passenger. Is it a wonder that the scar had given way? Scars of six days old are so soft that a finger can be pushed through them. For the growth of tough fibrous tissue a much longer period of time is required.

Among the special operative defects which favour a return of hernia, suppuration of the wound must be mentioned. But there are others. One of these is

the omission of any attempt to restore the obliquity of the inguinal canal. It is quite true, as stated above, that in certain cases of protrusion into a congenital sac, provided that the rupture has not come down so often as to effect materially the anatomy of the inguinal region, removal of the peritoneal sac alone may be sufficient to effect a radical cure. Yet there is a very real danger that surgical teaching may lay too great an emphasis on this possibility. Moreover, it is not possible for a surgeon to know for certain how often the rupture has been down or for how long a time it has existed. He will, therefore, if he is a wise man, always ascertain for himself the condition of the posterior wall of the inguinal canal, and will not fail to take measures to fortify it if it appears at all defective. And in connection with this matter it is necessary to direct attention to an error which is not infrequently committed, namely, to rely upon suturing the arching fibres of the transversalis and internal oblique muscles to Poupart's ligament at the outer part of the inguinal gap. This procedure contains the elements of two fallacies. In the first place, the muscular fibres are unsupported by aponeurosis in this region, and therefore the stitches cannot be relied upon to resist any tension placed upon them by the efforts of vomiting, coughing, or other movements which will cause them to tear through the soft muscle. Secondly, such a method will reduce instead of increase that obliquity of the inguinal canal which it is one of our main objects to secure.

The proper way to diminish the inguinal gap is to

start at the inner end and to suture the conjoined tendon to Poupart's ligament. The sutures will hold here, while the resulting anatomy will be such that the spermatic cord will pass obliquely through the abdominal wall, and the internal and external abdominal rings instead of being approximated will be wide apart—a relationship, or rather the absence of a relationship, which will have a considerable influence in preventing a repetition of the hernia.

A minor point which it may be worth while to mention is the desirability, when closing the wound towards the completion of the operation, of uniting with fine catgut the cut edges of the deep layer of the superficial fascia, which is a distinct structure in this region. By doing this we shall secure a better scar, and this may be of material importance, especially if the hernia subsequently recurs and the patient has to wear a truss.

These are fundamental principles, but it is necessary to enunciate them here, as a failure to give them due recognition is a common cause of unpleasant sequels.

In carrying out these operative procedures, it is possible unless great care is exercised to cause accidental injury to certain structures which come into relationship with the field of operation.

Ilio-inguinal, Ilio-hypogastric, and Genito-crural Nerves.—Of these the most likely to give trouble is the ilio-inguinal, which may be seen during operation lying upon the arching fibres of the internal oblique and transversalis just above and adjacent to the spermatic cord. Unless care be taken the nerve may be injured when cutting

through the aponeurosis of the external oblique, when suturing the conjoined tendon to Poupart's ligament, while uniting the cut edges of the external oblique aponeurosis, or while reducing the size of the external abdominal ring. The result of such injury may be a persistently tender scar.

When in France I had under my care a soldier who had previously undergone two operations for the cure of a right inguinal hernia. The hernia had recurred, and he could not wear a truss on account of the tenderness of the scar. Close examination revealed an area of anæsthesia corresponding to the cutaneous distribution of the ilio-inguinal nerve, while pressure with the finger at one definite point on the scar caused considerable pain. I operated rather with the intention of finding and dividing the nerve on the proximal side of the scar than with the hope of curing the hernia. However, I am ashamed to say the nerve could not be found. The scarring left by the previous operations was extensive and anatomical details were obscured. I had to be content with excising as much of the scar tissue as I could, and I cannot say what was the ultimate issue of the case.

I have no actual notes of cases in which unpleasant sequelæ have been attributable to trauma of the hypogastric branch of the ilio-hypogastric nerve, which lies perhaps rather above the field of operation, or of the genital branch of the genito-crural nerve which runs with the spermatic cord, but the matter may be mentioned in view of the possibility of trouble from such a source.

Damage to the Spermatic Cord is a not uncommon incident during operation for the cure of inguinal hernia The injury may concern the vas deferens, or the vessels of the cord, or both

The vas is most likely to be injured while separating the hernial sac, especially in young children, in whom the vas is a delicate structure and may be torn across quite easily if any roughness is used. In some congenital hernial sacs the vas lies in a peritoneal fold which almost amounts to a mesentery It is in separating the peritoneum over this fold that accidental injury is especially liable to take place Nor is it only during efforts to separate the sac that the vas may be damaged For, unless it has been separated from the sac right up to its point of exit from the abdomen, the vas may be drawn into the vortex when the sac is being twisted, and may be included in the ligature with which this structure is secured Laceration of the vessels is not likely to be followed by such unhappy consequences as is trauma to the vas, provided that the opened vessels are all properly secured Yet it is not at all a rare thing to see a large hæmatoma of the scrotum as a consequence of a hernia operation

I have had to operate upon a patient for internal hæmorrhage following an operation for radical cure I found the spermatic cord had been completely divided The surgeon who had operated was a competent man, and was completely mystified when informed of the accident

Swelling of the Testicle and Atrophy of the testicle

are not rare sequels to these operations, and one cannot help thinking that damage to the spermatic cord is the usual cause. *Hydrocele* is another occasional sequel to surgical procedures for radical cure, and it probably is the result of excessive trauma of the spermatic veins and lymphatics leading to their obliteration by ligature or subsequent thrombosis. *Varicocele* is a rarer sequel, and I have thought it due to excessive zeal in narrowing the external abdominal ring.

Wounding of the External Iliac or Common Femoral Vessels is a catastrophe. It comes about from passing the needle too deeply when suturing the conjoined tendon to Poupart's ligament; and it is to be remembered that these vessels lie immediately subjacent to the ligament. I have seen the external iliac artery so injured that its ligation was rendered necessary, and O'Conor[1] has referred to two instances in which the vein was wounded in a similar manner. Possibly also some of the cases of thrombosis of the femoral vein following operations for hernia are the results of such misadventures with the needle.

Wounds of the Bladder.—It sometimes happens that in the descent of a hernia a portion of the urinary bladder is dragged down along with the peritoneal sac; a thing that is especially liable to come about in connection with large hernias in elderly people. The bladder can easily be recognised as it lies attached to the mesial portion of the hernial sac. Nevertheless, it may be overlooked and included in the ligature with which the

[1] *B. M. J.* Vol. II. 1914, p. 115.

hernial sac is tied. A large number of examples of this unfortunate and dangerous mischance are to be found in the literature of surgery, and it is one therefore to which especial attention must be drawn.

Difficulty may be met with in finding the sac of a hernia, and a good deal of laceration of the spermatic cord may be the result of the prolonged search. This difficulty may be avoided if the sac be sought in the proper place, which is at the internal abdominal opening.

Whenever a hernial sac is tied and cut off, the ligature should be made to transfix the neck of the sac. Otherwise, the remains of the sac are liable to slip back into the abdomen leaving the ligature behind. The result of this is a raw surface within the abdomen to which gut or omentum may become adherent, with untoward consequences later on.

The question may arise as to how much of the sac it is desirable to remove. If the hernia is a congenital one and extends to the tunica vaginalis testis, complete removal of the sac not only will add considerably to the duration of the operation but it will greatly enhance the danger of injury to the structures of the cord. The sac is easily separable at its neck, that is to say, where it passes out of the abdomen. It is probable that inexpert surgeons, and perhaps the expert ones too, will be well advised to be content with division and ligation of the sac at this level in all those cases in which separation and removal of the whole sac is not quite easy. The only theoretical disadvantage is the possibility of the formation of a subsequent inguinal hydrocele. But

this risk may well be taken as preferable to the more serious ones which have been mentioned. These remarks are applicable only to the difficult cases. In those instances in which the sac is an acquired one and is easy to remove, it may be assumed that the operator would extirpate it entirely.

In large hernias of long duration there are two special difficulties which the surgeon must be prepared to face. One of these is brought about by the fact that the contents of these old hernias are sometimes bound together and to the sac by adhesions which are so strongly organised that complete disentanglement is impossible to effect with safety. In this case the best thing to do is to separate the hernial sac from the surrounding structures and to invert it with the bowel into the abdomen, having previously performed such limited discission of adhesions as may seem to be necessary and appropriate.

The other difficulty is in connection with old hernias which contain portions of the large bowel which are uncovered by peritoneum. In these ruptures segments of large intestine having no mesentery have slipped down through the hernial opening and have become attached to the soft tissues which surround them in their new abode. It is clearly impossible in these cases to tie off the sac at the level of the internal abdominal ring because the bowel itself forms part of the wall of the sac ; furthermore, it may be difficult to separate the bowel from the soft tissues to which it has become attached. The essential thing in these cases is to appreciate the

true condition of affairs at an early stage of the operation, before serious damage has resulted from futile and fumbling attempts to return the bowel within the abdomen and to remove the hernial sac. Particularly important is it to appreciate that the bowel is not merely adherent to the sac; it has slipped down and is really part of the sac, the hindermost portion having no peritoneal covering

Sometimes it appears that with very large hernias there has been difficulty in finding room for the errant structures within the abdomen This is not a very likely event if the patient has been properly prepared and the anæsthetist knows his business More real dangers are subsequent respiratory and cardiac troubles arising from compression of the thoracic contents during the early days following the operation; and to surmount these complications great attention will have to be paid to the avoidance of intestinal distension

Operating on the Wrong Side.—On one occasion I was requested at short notice to take the place of a colleague in the operation theatre A patient was placed upon the table, the clinical notes stated that he had a right inguinal hernia, and he had been prepared for operation accordingly Without suspicion I started to work, but could find no sign of a hernial sac Guessing that a clerical error had been made in the notes I then operated on the left side, found a hernial sac, and performed a radical cure Such confusion between the left hand and the right appears to be no rare thing in clinical note-taking; and it is naturally more likely to happen if

the notes are written from memory and not by the bedside.

Strangulated Hernia

Sometimes there is a difficulty in distinguishing a femoral from an inguinal hernia in the presence of strangulation. If a case be thought to be an example of femoral hernia and the common vertical incision be made, and the rupture then is found to be of inguinal origin, the surgeon will be hampered by his unsatisfactory incision. A transverse cut parallel with and close to Poupart's ligament will prevent trouble from this cause.

Viability of Bowel.—One of the most difficult problems a surgeon has to face is presented when, during an operation for strangulated hernia, he finds bowel concerning whose viability there is a doubt. There is no sure guide. As a rule gut which is shiny, elastic, without patches of gangrene, and without obvious malodour, may be replaced; though, as will be mentioned later, owing to thrombosis of its vessels or from other cause, such bowel may in certain instances give rise to trouble within the abdomen later on. Having decided that the intestine which is visible in the sac is in such condition that it may be returned within the abdomen, the next step will be to withdraw an additional length of bowel from the abdomen so that the portion that was actually exposed to constriction at the neck of the hernia may be inspected. The gut at this spot is apt to be ulcerated and perhaps perforated. I have known a life to be

lost from perforation and peritonitis owing to omission of this precaution.

It has been suggested that, in cases of doubt as to the integrity and viability of the strangulated gut, the gut should be reduced into the abdomen and a tube inserted through the hernial orifice in the hope of localising any subsequent peritonitis. This recommendation is based upon the erroneous supposition that the gut which has been reduced will remain in close proximity to the hernial opening; whereas it may take up a position far removed from this point, as I have been able to verify at the post-mortem examination of a case in which the method just mentioned had been adopted.

In order to reduce the strangulated bowel it will be necessary in most cases to divide the tissues which are causing the constriction. During this procedure there are one or two accidents which may come about. One of these is to wound the bowel with the hernia knife, and if the older method be employed of introducing a grooved hernia director into the abdomen along the inside of the sac and sliding a hernia knife along this *director and so dividing the constricting ring*, the accident is quite likely to occur, even if a wide-flanged director be used. For the bowel has an uncanny knack of slipping round the edges of the flange. Moreover, if there chance to be a slip of the bladder on the inner side of the peritoneal sac, it will be in great jeopardy if herniotomy be performed from within the sac; whilst in a tightly strangulated hernia there may be an impending perforation which the director will complete in a

manner that is not desirable. Therefore it is better to ascertain what tissues are responsible for the constriction and to divide these by cutting from without inwards, under the direct control of vision, so far as this course is possible. The method is slow but safe. And if the hernia director is necessary, for example, in order to effect a partial division of Gimbernat's ligament in the case of a femoral hernia, it should be introduced through the femoral ring between the sac and the ligament, and not inside the peritoneal sac.

Restraint must be exercised in dividing Gimbernat's ligament, as it is an important supporting structure extensive division of which will predispose the patient toward recurrence of the hernia. The cutting should be of the least extent sufficient to relieve the constriction.

There is another reason for being chary with the knife during this step of the operation, namely, the danger of dividing important vessels. For the possibility is always present that the obturator artery runs an abnormal course, being derived from the deep epigastric and looping round the front and inner border of the sac before passing backward to the obturator foramen. As this aberrant course is stated to be present in four per cent. of all subjects it constitutes a material danger if any haphazard surgeon is at work.

There is not likely to be any need for using a hernia director when the hernia is inguinal in origin, for the constriction in this type usually is located at the external ring. Nevertheless, it is to be remembered that the deep epigastric artery passes forward in contact as a rule

with the inner side of the neck of the sac; though occasionally it is to be found on the outer side. The vessel is a large one, and if cut will bleed ferociously, and it may be somewhat difficult to secure.

Resection of Intestine.—Reference must be made to a couple of important points in connection with resection of intestine which has become so damaged by strangulation that its removal is necessary. A natural impulse may lead the surgeon to resect the affected portion of gut and to perform anastomosis of the divided ends then and there as they lie in the existing operation wound. If he does this he is sure to find a difficulty, owing to its bulk, in replacing the anastomosed intestine within the abdomen. In fact, with a femoral hernia it will be necessary to divide Poupart's ligament in order to enlarge the opening sufficiently for the purpose, and there are manifest and grave reasons why division of Poupart's ligament should be avoided. Therefore, although the resection in some instances may be carried out, and the ends of the bowel closed as they project from the hernial wound, in order to perform the anastomosis a median laparotomy is required. If a long segment of gut has to be resected the whole procedure is best performed through the laparotomy wound.

The other point to which attention must be called is the common necessity for removing more than the segment which is actually gangrenous; the reason for this is that the distended bowel immediately proximal to the strangulated portion is distended, unhealthy, full of toxic contents, and possibly paretic.

Complications following operations for strangulated hernia may come about through the return of intestine which, though not gangrenous, has been so much damaged and perhaps thrombosed, that it fails subsequently to recover its function. These complications, apart from acute general peritonitis, are evidenced by obstruction. In certain instances, the blockage, which is of gradual development, is found to be consequent upon kinking and adhesions affecting the bowel and presumably resulting from a localised peritonitis; while C. A. Moore [1] has recorded another type in which stricture apart from adhesions has followed the reduction of strangulated bowel. The segment of bowel involved is thickened and rigid, while its lumen is greatly reduced. C. A. Moore gives to this condition the name of hypertrophic fibrosis of the gut, and gives references to several examples. I have had a case of this kind under my own care.

Umbilical and Epigastric Hernias

Before leaving the subject of hernia a few brief comments may be made relative to umbilical and epigastric hernias.

Umbilical hernias have no distinct peritoneal sac. Moreover, their coverings are often very thin, and their contents not infrequently are adherent to these coverings. Unless special precautions be used, therefore, the contents may be injured by the knife in opening up the rupture. For this reason it is best to commence by

[1] *Brit. Jour. Surg.*, Vol. I. No. 3, p. 361.

apart altogether from dysentery. It may be a manifestation of pyæmia, and especially of portal pyæmia following appendicitis or some other infected lesion within the abdomen; it has followed exploratory puncture of an empyema, the needle having passed through the pus cavity and the diaphragm into the liver, causing direct infection; and it may appear as a single lesion due to the *staphylococcus aureus.*

Definite and general enlargement of the liver is not a salient feature in the early stages of solitary hepatic abscesses. And in this connection reference may be made to the fact that patients with advanced cirrhosis or malignant disease of the liver quite commonly suffer from wasting and pyrexia, accompanied sometimes by rigors and a polymorphonuclear leucocytosis. As a rule, however, the clinical features, and especially the large, hard liver with its knobbly but distinct lower margin, are sufficiently clear to prevent misapprehension, provided that the clinician is aware of the concurrence of pyrexia and leucocytosis with cirrhosis and malignant disease.

When the presence of a liver abscess has been suspected, and the suspicion is supported by a thorough clinical examination, including numerical and differential blood counts, exploratory puncture should be carried out. There are certain points in connection with the technique of this operation which need a reference. The first is the necessity of using a large exploring needle or trocar and canula, because the pus of a liver abscess is thick and will not pass easily through a fine needle.

I have seen a liver abscess overlooked by the neglect of this precaution, and the oversight cost the patient his life. Secondly, the exploration should be carried out with the patient anæsthetised, both because the insertion of a large needle is painful—and several punctures may be required—and also because if the patient leaps with pain, as he may do when the trocar is pushed into him, his liver may be lacerated and extensive hæmorrhage brought about. In the absence of any indication as to the locality of the abscess, the best spot for exploratory puncture is two inches above the lower costal margin in the mid-axillary line. At this level the pleura is avoided, while the needle may be passed in from this point horizontally for a distance of four inches without encountering any vital structure—assuming the patient to be a well-grown man.

This site is also the best one, in the absence of obvious contra-indications, for the drainage of the abscess. The ribs are sufficiently separated to permit of the use of Manson's special apparatus, while even if an open operation be done, the danger of wounding and infecting the pleura is avoided. If for any reason a transpleural incision be used, and it be found that the two layers of pleura are not adherent, special pains must be taken to shut off the two layers of pleura by sutures before the abscess is opened, and it may be better to insert a plug of gauze and defer opening the abscess for twenty-four hours or so in order to secure a firm barrier against infection of the pleura, and so to avoid a serious and possibly fatal disaster.

The treatment of a tropical liver abscess is not merely a matter of drainage. In these dysenteric cases, abscess formation may recur. I have known a patient to undergo five operations in the course of seven years for recurrent abscess of the liver. To avoid these unpleasant sequels, good general therapy, including the proper use of emetine, are required.

Cholecystitis.—The correct diagnosis of cholecystitis is often fraught with difficulty and mistakes are numerous. Possibly these would be fewer and treatment would be more timely and effective if it were more generally realised that "an attack of gall-stones" usually is an attack of cholecystitis in which gall-stones may or may not play a part. The inflammation consequent upon bacterial invasion is to be regarded as the common cause of pain rather than the passage of a stone along the ducts.

The pain of cholecystitis frequently is mistaken for that of appendicitis, and this is, perhaps, the most likely pitfall; but there is hardly any abdominal lesion for which disorders of the gall-bladder have not been mistaken. An errant and distended gall-bladder has even been diagnosed as an ovarian tumour. In differentiating an acute cholecystitis from appendicitis, perhaps the most important points are the careful localisation of the maximum points of tenderness and abdominal rigidity.

A Riedel's lobe is occasionally mistaken for a distended gall-bladder. The lobe consists of a tongue-like projection of the liver, and although it lies laterally

to the gall-bladder, it may lead one into error. A lady consulted me about a recurring pain in the right abdomen. On palpation an elongated, smooth, slightly tender, movable swelling could be felt, which was regarded as a distended gall-bladder. Laparotomy revealed a normal gall-bladder, the tumour being a largely developed Riedel's lobe. This lobe has been stated to be always associated with the presence of gall-stones, but in this case, at any rate, there was no evidence either of gall-stones or of cholecystitis.

Considerable difficulty may arise in distinguishing between renal and biliary calculi. I was asked on one occasion to operate upon a stout, plethoric gentleman for stone in the right kidney. He was stated to have had several attacks of renal colic and to have had hæmaturia. Examination revealed little information beyond the presence of tenderness in the region of the gall-bladder. Radiograms showed the shadows of three calculi in the right renal region. I asked the radiographer how he could be sure that they did not represent biliary calculi. He replied that they were in the correct position for renal stones; they were not faceted, and they were remarkably well defined considering the stoutness of the patient.

Having explored the right kidney without finding what I sought, I then examined the gall-bladder, whence I removed the three calculi which had produced the shadows on the photographic plate.

Lateral X-ray photographs may be useful in distinguishing between renal and biliary calculi, for in the

former case the shadows will lie entirely, or for the most part at any rate, behind the anterior margin of that which represents the spinal column, while the shadows of biliary calculi may be expected to fall in front of this line.

The pain and other symptoms of cholecystitis are particularly susceptible of being mistaken for the results of some intra-thoracic morbid process. Owing to the relative fixity of the right side of the diaphragm and the lower part of the right chest wall which often accompanies inflammatory conditions of the subjacent abdomen, attention may at once be directed toward the lungs and pleura; and since secondary pulmonary collapse is not uncommon, the whole condition may be erroneously regarded as one of pneumonia or pleurisy, and especially so as basal crepitations and friction sounds are not uncommonly present. The rub which occasionally is audible with the stethoscope may be explained by the existence of perihepatitis.

Operations upon the Gall-bladder and Bile Ducts.—For these operations a substantial loin pad is necessary in order to effect rotation of the liver so as to expose the subhepatic structures and to project these forwards and by this means render them more easily accessible. On opening the abdomen the first step should be to examine the gall-bladder and the bile ducts; and it is a good practice to observe the condition of the pancreas at the same time. We are apt, when disease of the gall-bladder is manifest, to forget to examine the ducts until a later period of the operation, and in consequence

we may find ourselves at a disadvantage. To expose the gall-bladder and ducts fully it will be necessary to raise up the liver. To effect this, the lower margin should be grasped between two layers of gauze and gently drawn upward. But this traction must be gentle. I have seen a liver rather badly lacerated during the manœuvre, and deep sutures were necessary to check the hæmorrhage which resulted.

In palpating the common duct the surgeon must be careful not to confuse an enlarged lymphatic gland lying alongside the duct for a calculus within its lumen, or he may be enticed into an unprofitable and tiresome wild-goose chase.

I feel sure that the surgeon, on finding an inflamed gall-bladder containing calculi, may forget to examine the remainder of the biliary passages; more than once have I operated upon a case of chronic biliary fistula following drainage of the gall-bladder and have found a stone in the common duct.

Nor is it always a simple matter, even when we do make the attempt, to be perfectly sure whether there is or is not a biliary calculus present; because the duct cannot be effectively palpated at its lower end owing to the presence of the pancreas, and a stone lodged at this level may escape detection by the most skilful fingers; nor are probes of any material assistance. There are, however, two clues to the presence of a stone lodged in this region, namely, dilatation of the common duct and thickening of the head of the pancreas. Discovering these conditions, we may be almost sure that

a stone is present, and may endeavour by varying pressures to squeeze it upward along the dilated duct, and so render it accessible to easy removal.

There is a real danger that the operator, finding the head of the pancreas to be thickened, will attribute the thickening to pancreatitis, and fail to seek, detect, and remove the calculus—a disastrous and not uncommon error.

When cholecystitis is present it is not always easy to decide whether to remove the gall-bladder or merely to provide for its drainage. On the one hand, we know that a chronically inflamed gall-bladder is a useless possession at the best, while it not uncommonly becomes the seat of cancer; on the other hand, a cholecystectomy is a more severe operation than cholecystostomy; moreover, it deprives us of a ready means of effecting drainage at a subsequent date should this be required on account of chronic pancreatitis or for some other reason. A sound rule for the average surgeon would be that a complete excision should be performed only in the case of a chronically inflamed, functionless gall-bladder, and that in all other cases the surgeon should limit himself to a partial resection or to mere drainage.

Two special points in connection with cholecystectomy need remark. The first is the necessity of retaining as much as possible of the peritoneal covering of the gall-bladder, in order that its cut edges may be united afterwards so as to cover in the raw surface of

the gall-bladder, this cannot be done, and the formation of dense and perhaps troublesome adhesions is to be expected. The second point is to secure the cystic artery at an early stage of the operation, before commencing to separate the gall-bladder from the liver. This order of procedure has the advantage of preventing a certain amount of loss of blood which otherwise would obscure the field of dissection, cause delays, and be generally undesirable. *Bleeding from an* imperfectly secured cystic artery occurred in the practice of one of my friends. A second operation revealed the source of hæmorrhage, but failed to save the patient's life.

Another danger in connection with cholecystectomy is wounding of the hepatic and common ducts at the point where they are joined by the cystic duct. In cases of *long-standing cholecystitis the cystic duct may be much* shortened, and unless in such a case the common and hepatic ducts be exposed to direct inspection, they may be wounded when the surgeon is under the impression that he is cutting through the cystic duct alone.

In some individuals the portal vein passes upward in front of instead of behind the duodenum, common bile duct, and hepatic artery; and in such a case it might easily be injured in the absence of a good exposure and definition of the structures lying in the operation field.

Complications.—Hæmorrhage is a real menace after operations upon patients who are jaundiced, and especially so if the cholæmia is of long standing or is

profound. In all such cases there are two precautions to be taken in order to reduce and if possible to eliminate the danger. The one is to examine the patient carefully for any signs of purpura. The discovery of petechiæ is to be regarded as an absolute contra-indication to operation; in their presence any contemplated surgical interference must be postponed until the coagulability of the blood has been increased by the administration of calcium chloride, serum, hæmoplastin, or by other means. And in every case in which jaundice exists, even without purpura, it will be a wise previsionary measure to administer calcium chloride before and after operation. Meticulous hæmostasis at the time of operating is another sound precaution.

Biliary Fistula.—We need not be greatly disconcerted if little or no bile escapes for the first day or two after a drainage tube has been inserted into the gall-bladder. The absence of an immediate and copious flow is not uncommon, and is attributable to inflammatory swelling of the mucous membrane of the cystic duct. This usually rights itself and the drainage soon becomes effective. More troublesome is a failure of the fistula to close at the proper time. The continued discharge of bile, unless it be due to the odd misdeed of suturing the wall of the gall-bladder to the skin, will denote that *there is some obstruction of the common duct*—probably an overlooked calculus; if, on the other hand, the effluent consists of mucus without bile, the cystic duct is the seat of *some impediment*. The continued discharge of pus unmixed with bile or mucus, and

due to an infected suture, is not, of course, to be misconstrued as a biliary fistula.

I have known a case in which a persistent sinus eventually was found to be caused by a small swab which had been inserted into the gall-bladder at the time of the operation, and forgotten.

CHAPTER XIX

THE SPLEEN

Rupture of Spleen.—Laceration of a diseased and enlarged spleen may cause death in a manner which can almost be described as immediate. But with normal spleens, and in the absence of severe damage to other organs, an interval of time often follows the injury, during which there may seem to be but little amiss with the patient. This latent period is fraught with peril both for the welfare of the patient and the reputation of his doctor, for reasons which are self-apparent (see p. 99). Moreover, recurrent internal hæmorrhage is especially frequent with a ruptured spleen. And herein lies another snare for the unwary. For the patient, after an initial hæmorrhage, may show such a striking and continued improvement that there is a temptation to delay operative measures. A second bleeding follows, perhaps more copious than the first; the patient becomes blanched, restless, and so desperately ill, that to leave him at rest is judged to give him the best opportunity of survival. Again he improves so quickly that operation is once more postponed, and again the internal hæmorrhage is repeated. This see-saw business is not uncommon, and the lack of surgical knowledge or decision in these cases has

proved to be costly. Patients, therefore, who are thought to have a torn or crushed spleen should be operated upon at the first favourable opportunity.

Enlarged Spleen.—Splenic enlargements may be confused with various other swellings originating within and without the abdomen. The differential diagnosis, however, is too large a subject for discussion here. We shall set out, therefore, from the proposition that the surgeon is called upon to advise upon the desirability or otherwise of removing a tumour which is without doubt an enlarged spleen.

To give the proper counsel he must consider the nature of the enlargement. To undertake the removal of the spleen in a case of leucæmia would be a first-class surgical misdemeanour, to avoid which the surgeon must be informed as to the condition of the patient's blood. Now he may be told that there is no contra-indication to operation, that there are no abnormal cells and no leucocytosis. Let him then ask how many times the blood has been examined, and if it has been examined but once, he should withhold his hand until a little time has elapsed and the investigation has been repeated. Indeed, it is not unreasonable to ask for the results of three successive blood examinations before coming to a decision. These operations are not to be rushed upon. Deliberation must be exercised.

The following case illustrates the application of this advice. I was consulted about a man who had an enlarged spleen, the removal of which was rather strongly urged The blood had been examined and the report

corpuscles was found; there appeared to be about one white to every eight or ten red cells. The character of the tumour and the extent of the leucocytosis led to a diagnosis of leucæmia. As a matter of fact, the patient was suffering from pyonephrosis and perinephric abscess brought about by a renal calculus.

Splenic Anæmia.—Since removal of the spleen is now being recommended in cases which are diagnosed as "splenic anæmia," it is worth while mentioning that in the presence of recognisable cirrhosis of the liver or ascites, the operation is likely to be disappointing in its results. The abdomen, therefore, should be specially prospected for these conditions.

Removal of the Spleen.—The best incision is perhaps a vertical one through the left rectus muscle about two or three inches from the middle line, and it must be large enough to allow the spleen to be delivered. As Owen Richards [1] has pointed out, if the incision be placed in the mid-line there is not good access to the outer side of the spleen, while it may be difficult to bring the organ out of the incision before dividing the pedicle; if, on the other hand, the incision be placed further out, the costal margin prevents the surgeon from extending the opening upward sufficiently to give a good approach to the vault of the diaphragm, where much of the difficulty from adhesions is likely to be found. These adhesions often are copious, but they usually can be separated by tearing them through with the fingers, though judgment is required to avoid lacerating the capsule or thrusting

[1] *Brit. Jour. of Surg.*, Vol. I. p. 419.

Section VI. KIDNEY, URETER, AND PELVIC ORGANS

CHAPTER XX

KIDNEY AND URETER

Diagnosis of Renal Injuries

A case of supposed rupture of the kidney from violence presents, or ought to present, many problems of interest to the surgeon. In some cases the diagnosis is easy and the chances of error are few: the patient has clearly suffered from a severe traumatism in the renal region; he has much pain in the loin, where the muscles are on guard and a swelling can be felt; the loin and hypochondrium are acutely tender; the patient suffers from shock and is passing blood with the urine. But the problem is not always so simple as this, for one or more of the leading features mentioned above may be absent. Thus a man, aged fifty-nine,[1] struck his left side in falling down some steps. He felt a sharp pain in the injured part, but arose and went about his work. Apart from a "stitch" in the left side and some difficulty in taking a long breath, he complained of nothing. Nearly eight hours later, however, there was painful and

[1] Quoted from a paper by A. B. Johnson, *Medical Record*, April 9, 1910, p. 603.

existing lesion; and an X-ray photograph revealed the presence of a renal calculus.

Another interesting case which caused much perturbed discussion at the time among the medical men in attendance, was that of a gentleman who was visiting some docks when by a mischance he fell off a jetty into the water some fifteen feet below. As he plunged into the water he just missed striking the gunwhale of a small rowing-boat. When rescued he complained of great pain in one loin, which soon became intense, and which was accompanied by hæmaturia. It was believed that he must have ruptured a kidney, although he was certain he had struck no obstacle but the water. As a matter of fact, he went through a severe attack of renal colic, terminating with the passage of a calculus which had become dislodged by the sudden jolt of the patient's fall.

Another example of hæmaturia following a slight injury of the kidney is that of an apparently healthy young school-girl who, while playing "follow my leader," tripped over a pile of stones on the roadside. She suffered not only from hæmaturia, but from all the chief symptoms which commonly indicate a ruptured kidney, that is to say, shock, severe pain, and tenderness in the loin with a palpable swelling in this region. Owing to the slightness of the original injury it was nearly certain that the kidney had been abnormal beforehand. Operation was performed and a sarcomatous kidney was removed.

A curious complication of ruptured kidney, to which

special attention may be called because it is so easily overlooked and because so little has been said about it in the literature, is pleural effusion. The occurrence has been recorded by Coleman,[1] and in my own experience the complication has been not a rare one.

Treatment of Renal Injuries

In the after-treatment it is reasonable to administer urinary antiseptics. But it is worth remembering that large and concentrated doses of hexamine may alone be sufficient to cause hæmaturia, and if hæmaturia be already present, the ill-regulated dosage of the patient with this valuable drug may favour a continuance of the symptom.

I was asked to see such a case of persistent bleeding, and found that the patient was taking ten grains of the drug in compressed form every four hours. The hæmaturia ceased directly the drug was withheld. This may have been chance, of course. Nevertheless, it perhaps serves to point the warning that hexamine should be given in free dilution lest it favour the continuance of bleeding from the kidney.

As regards the operative treatment of ruptured kidney, it is so much the tendency of the modern surgeon to cut down upon obvious lesions that perhaps I may be excused for using the present opportunity to oppose the practice of open operations as a routine treatment in these cases. Whether in the hands of surgeons of large and special experience operative treatment

[1] *B. M. J.*, Vol. I. 1905, p. 942

is in general more or less successful than masterly inactivity is not the chief point. The sure thing is this, that the surgeon of small experience will achieve better results in these cases if he reserves the knife for that minority of patients who suffer from continued hæmorrhage, or in whom consecutive sepsis or some other complication develops calling unmistakably for operative interference, and in the majority of these cases a nephrectomy will be desirable.

The fact is, though it is not sufficiently well recognised, *that the majority of operations performed in this country* are carried out by surgeons of average ability and moderate experience. *And if ever precepts for routine* surgical treatment are to be laid down, this fact should be recognised and the rules made accordingly. Unfortunately, guidance is too often accepted from the superior class of surgeons and from those whose experience is of a special nature and whose special skill cannot be emulated by the average man, who in consequence of following this leadership is apt to aim higher than he can hit, with consequent failures for which the patients have to pay

Renal Calculus

Diagnosis.—The presence of colic, localised to the region of the kidney and ureter, not infrequently is regarded as sufficient evidence of a renal calculus. But the fallacies here are almost too numerous to mention. Even when the colic is accompanied by hæmaturia, it is unsafe to assume, without other evidence, that a

stone is present. For lesions of the kidney other than nephrolithiasis may cause colic and hæmaturia. Moreover, these two symptoms may be the consequences of unhealthy processes in other than the urinary organs.

Lockwood [1] has referred to the occasional occurrence of hæmaturia in appendicitis. The following is an example from my own experience. A boy of thirteen years suffered from recurrent attacks of colicky pain in the right iliac region. Examination of the urine during one of these attacks showed the presence of blood, without pus or casts. The case was regarded as one of renal colic; but as no stone was revealed by skiagraphy an operation was not suggested. A little later an attack of acute appendicitis led to removal of that organ, which contained a concretion. During the seven years that have supervened there has been no recurrence of colic or hæmaturia.

So many mistakes have been made by accepting colic as evidence of nephrolithiasis, that the mention of additional examples will be pardoned.

A young officer in the army suffered from attacks of pain which were thought to be due to a stone in the kidney. On two occasions radiograms were taken, but they failed to show any indication of a calculus. Nevertheless, he was advised to have the kidney explored. To this he agreed, and a nephrotomy was carried out, but no calculus or renal abnormality was found. The operation was followed by hæmaturia, which persisted through many days, so that the patient's condition

[1] "Appendicitis," 1901, p. 134.

became desperate. In these circumstances nephrectomy was performed. *The man died of shock.* The kidney apparently had been a healthy one.

Here is another instance. A man suffered from symptoms supposed to be due to the presence of a stone in the kidney. Although no stone was revealed by examinations in the radiographic department, yet it was thought desirable to explore the kidney. This was done, but no stone or other lesion was discovered. After the operation the patient suffered much from pain, while urinary hæmorrhage was continued and profuse. To give him ease, morphia was administered repeatedly. As a consequence of the morphia and other causes *suppurative parotitis developed, followed by facial paralysis,* thrombosis of the cavernous sinus, and death.

I have seen so-called renal colic with hæmaturia, at first thought to be due to a stone in the kidney, prove later to have resulted from carcinoma of the uterus. In one case the first symptoms of a malignant growth *of the left ilium were hæmaturia and "renal colic."* Radiograms failed to show any stone, but they revealed the growth in the ilium. Major D. Simpson [1] recorded an example in which a left kidney was explored for stone with a negative result. Later the patient was found to be suffering from *carcinoma of the rectum.* Doubtless a great number of examples could be found to illustrate this simple fallacy of diagnosing nephrolithiasis on the basis of colic and hæmaturia alone.

Before leaving the matter of the significance of

[1] *Annual Report,* 1904, Government General Hospital, Madras.

colic reference must be made to the fact that pain in one renal region may be due to disease of the fellow-kidney, and the possibility of faulty localisation due to this crossed reference of pain has to be considered. Thus, Maylard [1] mentions a case—dating from the days prior to radiograms—in which the patient "complained of pain in the right lumbar region, strongly suggestive of renal colic. The kidney was cut down upon and explored, but no stone was found. The patient died four days after the operation from suppression of urine, and at the necropsy a stone was found in the left kidney."

For another reason pain may be a misleading guide in the localisation of renal trouble; the painful kidney may be the less diseased one, where both are affected.

The first moral to be derived from the foregoing remarks is that no patient should be submitted to an exploration of the kidney on the supposition that a calculus is present unless and until a thorough investigation has been made by radiography. For by this means alone can the presence of a stone be diagnosed, prior to operation, otherwise than by guesswork. And not only can the presence of a calculus be shown, but its position also can be rendered evident—a matter in itself of considerable moment. The stone may be in the ureter, there may be more than one stone present, or there may be calculi in both kidneys—all of which details it is well for the surgeon to know before he starts cutting the patient.

[1] *B. M. J.*, Vol. I. 1921, p. 733.

Fallacies occur, of course, even in radiography, and a shadow caused by a calcareous lymphatic gland or some other structure or substance may lead to a mistaken diagnosis of renal calculus. Gall-stones are, in certain instances, exceedingly difficult to distinguish from renal calculi, and both the symptoms and the radiographic showings may lead to confusion. A more detailed reference to this matter is made (p. 209) under the heading of Cholecystitis.

Suppose a case in which, although symptoms are observed which suggest that the kidney contains a stone, yet none can be brought to light by repeated examinations with the X-rays. What advice is the surgeon to give *in such a circumstance ? My own rule is to recommend* medical treatment and to advise against the performance of an exploratory operation. The main reasons for this attitude are these. In the first place, nephrotomy is no small event for any individual. I should not submit to its performance on myself unless sure that the diagnosis had a firm foundation. Secondly, as shown by the cases mentioned above, a stone or other detectable lesion may be absent from the kidney or ureter in spite of the suggestive symptoms. Thirdly, if a stone is present and yet cannot be shown by skiagraphy, it is likely to be a small one. And small stones may pass out by the natural channels, which is a better way than *through a wound in the loin.* Moreover, a small stone may be difficult to find even when the kidney has been brought out of the body and split open during a nephrotomy—indeed it may be missed. For these

It was evident that the nerve supply of the right lower abdomen had been severed in the incision; and the absence of a lumbar hernia is perhaps to be explained by the lowering of the intra-abdominal tension brought about by the muscular paralysis.

Even with the normal incision a good deal of discomfort may be inflicted on the patient by injury to certain nerves. The last dorsal nerve—parallel with and close to the lower border of the last rib—the ilio-inguinal and ilio-hypogastric, which are an inch or so lower down, may any of them be injured during operations on the kidney, for they lie in close relationship with its posterior surface, and are especially liable to be included in a ligature or in sutures used to unite the cut edges of the anterior layer of the lumbar aponeurosis.

A lady who had undergone nephropexy suffered great misery thereafter from traumatic neuritis of the last dorsal nerve. The actual involvement of this nerve in the scar was easily demonstrated and a resection effected by means of a transperitoneal incision, after a previous attempt by the lumbar route had failed. The patient was cured immediately of her pain, but not of the morphia habit to which she had meanwhile become addicted.

During endeavours to deliver the kidney, especially in a stout, thick-set subject, it is possible not only to bruise the kidney somewhat badly, but to cause hæmorrhage by laceration of veins at the hilum. To lessen these dangers it is advisable to make a sufficiently large wound in the parietes, and if necessary to fracture and retract the last rib.

Instances have occurred in which the inferior vena cava has been torn during the separation of a right kidney in the presence of adhesions due to perinephric inflammation. The duodenum and colon are also in some danger in similar circumstances.

I have heard that there is a danger of replacing the kidney upside down, that is to say, with a twisted pedicle, and though I cannot verify this by quoting an instance, the danger does seem to be a real one and should therefore be borne in mind.

Perhaps the greatest of all perils attendant upon nephrotomy is the continuance of renal hæmorrhage after the operation. Defective suturing is the cause of this; the stitches having failed to occlude the deeper parts of the renal incision. These stitches should pass through the entire parenchyma of the gland, stopping just short of the pelvic epithelium.

Such sutures should be fine and of material which can be readily absorbed, otherwise they may form the nucleus of calculi. Firm but gentle pressure is all that is required. This warning is necessary, for if excessive force is used the fine sutures will either break or cut through the substance of the kidney. Another plan for lessening this hazard of subsequent hæmorrhage is to remove the calculus by the way of an incision through the pelvis of the kidney whenever such a course is possible. The advantages of this route are so manifold and obvious—apart from the security it offers against continued renal bleeding—that no special commendation is necessary.

Reference has been made already to the possibility of overlooking a stone in the kidney during a nephrotomy. Particularly easy is it, when two or more calculi are present, to leave one or more behind. And especially is this likely to occur when one of the stones is large and obvious while another is small and well secreted in one of the renal calices. To lessen the chances of such an awkward oversight the patient's radiograms should always be available in the operation theatre, and reference should be made to them before the kidney wound is closed.

Sometimes it is desirable during a nephrotomy to pass a probe down the ureter, but this will in many cases be impossible unless the incision into the kidney is placed high up in the organ so that the probe can be passed downward through the superior calyx. In the natural position of the kidney it is the upper calyx which continues the line of the ureter.

Nephrectomy

Removal of a solitary kidney, or of one kidney when the remaining organ is so defective that it is incapable of meeting the vital demands of the patient, is a favourite subject for witticism at the surgeon's expense. However, I shall refrain from repeating the famous anecdote thereanent, because I suppose that every medical man has heard it and passed it on at some time or other.

There is one rather rare condition in which a solitary kidney may be removed in ignorance of the fact that it is a kidney at all. I refer to that case in which there is

congenital absence of the vagina and uterus. Here there commonly is a solitary, globular kidney situated in the pelvis. The surgeon may mistake this for a hæmatometra due to atresia of the exit. On opening the abdomen to investigate he finds a sessile, globular tumour, which he shells out easily enough, and only too late does he discover that he has deprived the patient entirely of her renal apparatus. Such an accident has come about more than once.

Ureters

There is one little and perhaps infrequent oversight in connection with the lodgment of a stone in the ureter which it may be worth while to mention. The pain which the affair causes may be attributed to appendicitis. Operation is advised and carried out. The appendix may show signs of past inflammation ; many appendices do. On the other hand, it may seem normal—to the relations perhaps it will be described as abnormally long, or kinked, or congested—we have all seen these appendices—and the surgeon quite properly removes it. But he may forget to make a systematic search for other possible sources of the pain which tormented the patient. And one of the possible things which may be found in the course of such an inquiry is a stone impacted in the ureter.

But the chief interest of the ureters so far as this book s concerned is their accidental division or ligature in the course of some operation in their neighbourhood. The procedure during which unintentional division

of a ureter most commonly takes place is total hysterectomy for malignant disease of the uterus, and the accident appears to have happened at the hands of the most crafty surgeons. But the better the surgeon the less likely is he to cut a ureter unintentionally. *An intimate knowledge of their anatomy and a close* acquaintance with their appearance will reduce the likelihood of this mishap to a minimum.

The remedy is to anastomose the divided ends, or to implant the ureter into the bladder if either of these plans be possible. If for any reason neither of these remedies is applicable—a portion of the ureter may have been inadvertently excised, or the time required for restoration of the tract may place too great a tax on the patient—the best thing to do is to ligate the proximal end; the kidney from which the ureter issues will then atrophy without causing the patient much recognisable inconvenience, provided of course *that the other ureter and kidney are healthy and intact.*

CHAPTER XXI

THE BLADDER, PROSTATE, URETHRA, AND PENIS

The Bladder

I have not heard of many accidents arising in connection with the surgery of the bladder. There are numerous misadventures to which this receptacle is exposed during operations upon other organs. It may be accidentally wounded during laparotomy of the lower abdomen, and it has been mistaken for an ovarian cyst and punctured with a trocar. But these accidents will only happen if the bladder be distended, which it never ought to be during abdominal section. In any case they do not properly call for discussion in a chapter on the surgery of the bladder. These injuries, and others, including wounds of the bladder during operations for hernia, have been referred to elsewhere.

Supra-pubic Cystotomy

There are two outstanding faults that require notification in connection with supra-pubic cystotomy. The one is accidental wounding of the peritoneum. If the bladder be well distended it is unlikely that the peritoneum will be cut through even by a careless surgeon, and the bladder ought to be distended. If,

on account of cystitis or for other reason, the bladder cannot be made to hold much fluid, or if the peritoneal fold extends downward in front of the bladder to an unusual distance, a very little manipulation will suffice to push up the peritoneum to a safe level. The peritoneal fold can be seen, recognised, and handled.

The other fault is merely to puncture the bladder with the knife. This allows the fluid to escape; the bladder contracts and the puncture may then be difficult to find. The knife ought to be plunged into the bladder, a downward cut made, and one or two fingers at once inserted; or the cut edges of the bladder should be immediately picked up and retained with forceps.

Lithotrity

A few years ago there was a discussion in surgical circles concerning the respective merits of lithotrity and supra-pubic cystotomy. Now supra-pubic cystotomy is such a straightforward and successful procedure that the general surgeon should have no desire to practise the alternative. If he does so he will be seeking and finding trouble. He will damage the bladder wall, fail to get rid of the calculus, or perhaps, though everything has gone off surprisingly well, the patient will shortly again be troubled with vesical calculus owing to a fragment having been left behind. Indeed, I have known a surgeon, more enterprising than wise, proceed to attempt lithotrity when the bladder itself was already so badly infected that supra-pubic cystotomy was indicated for the treatment of the sepsis alone.

It is not justifiable for a novice to practise lithotrity, with the very high morbidity risk which the operation carries in hands that lack experience, unless as a prelude to the treatment of great numbers of patients with stone in the bladder. The operation is one for the specialists and for them alone.

An easy and satisfactory method of draining the bladder is by means of a self-retaining catheter introduced through a supra-pubic puncture made by the instrument designed by Sir Patrick Manson for draining hepatic abscesses.

Enlarged Prostate

Concerning the diagnosis of prostatic enlargements there is a certain amount to be said. In the first place, it may be erroneous to assume, because a middle-aged or elderly man has retention of urine, while a full-sized catheter can be passed into his bladder, that therefore he has an enlarged prostate. I have known of two instances in which such an assumption was made the basis of operative interference and no prostatic enlargement or other urinary obstruction was found; the patients were afterwards found to be in an early stage of paralytic dementia.

To diagnose prostatic enlargements additional evidence beyond the mere fact of retention of urine is required. Palpation *per rectum*, and the discovery of residual urine, are two such additional points of importance in support of a diagnosis of enlarged prostate.

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Prostatectomy

With a large prostate and a healthy bladder the operation of supra-pubic prostatectomy is a rapid and easy operation, and it is probable that most of the failures that occur are due to the absence of one or other of these two factors.

If the bladder be septic and the urine alkaline, it will be a wiser course to perform a preliminary supra-pubic cystotomy, and by drainage of the bladder and the administration of drugs, such as boric acid, acid sodium phosphate, hexamine, sodium benzoate—accord-to the nature of the bacterial invasion—to improve the condition of the urine. What happens when a prostatectomy is performed on a patient with septic and alkaline urine is this: phosphatic material becomes deposited upon the raw surface, which is thereby prevented from healing; while if by some chance the supra-pubic wound does heal, the patient is left with a stone in the bladder. The surgeon who has had one such case will not desire another.

Caution is required regarding the use of boric acid; although it is one of the best drugs for acidifying the urine, yet it has these drawbacks, that its continued use may cause severe eczema, while in gouty subjects it may bring on an acute exacerbation of that disease.

Hexamine, as mentioned on another page, if taken in strong doses and not well diluted, is apt to cause hæmaturia.

Drainage of the bladder through a wound above

the os pubis can be carried out without making the patient's life a misery by the help of a Marshall's supra-pubic box.

As to the condition of the prostate itself, I have intimated that a large prostate is more easy to enucleate than a small one. This is merely speaking in loose phraseology. True enucleation of the prostate is an exceedingly difficult operation; enucleation of an adenomatous growth from the prostate is easy—that is to say, it is easy provided that the adenoma is large enough to give leverage to the enucleating finger, and the larger the adenoma the easier is its removal.

I have succeeded by means of a supra-pubic incision in enucleating a prostate which contained numerous calculi but no adenoma, and although the patient made a good recovery the operation was long and put his endurance, and mine, to a severe test; and I shall not with any happiness again subject a patient to the operation.

On another occasion when I opened a patient's bladder in order to remove a prostate, I found no rounded knobs or bulky lumps in that organ, but the orifice of the bladder was surrounded by a hard fibrous ring. I proceeded to perform enucleation, and eventually I succeeded in removing about two drams' weight of torn fibrous unrecognisable material which I think was prostatic. Again the patient was put to a most violent and prolonged test of his endurance. I know now that to try to enucleate these small fibrous "ring" prostates is a perilous mistake. Men are naturally reticent about

their misdeeds, but many surgeons have learned only by their own experience, just as I have had to learn by mine, that *to attempt the enucleation of a small fibrous prostate is to place a patient in peril*. This, I think, illustrates the need there is for a book which will chart some, at any rate, of the errors which surgeons may not otherwise know how to avoid.

Sir J. W. Thomson Walker has drawn attention to *the importance of a direct inspection of the interior of* the bladder as soon as the prostate has been removed, both for the purpose of securing any arteries that may be large enough to cause troublesome hæmorrhage—they are to be found near the raw edges of the mucous membrane of the bladder where it surrounds the cavity from which the prostate has been enucleated—and also in order to make sure that there shall be no subsequent difficulty of urination owing to blockage of the urethra by a tag or flap of tissue or other cause.

I have seen a case in which, following a prostatectomy, the patient failed to regain any power of urethral micturition, the supra-pubic sinus remaining unclosed. On opening the bladder and inspecting its interior, there was no discoverable channel into the urethra, its locality being represented merely by a scar.

Rupture of the Urethra

The usual position for a rupture of the urethra from violence is just below the triangular ligament. This is the classical form of the injury; its symptoms, and the characteristic manner in which the extravasated

urine follows the route determined by the attachment of Colles's fascia, are well known. A less familiar lesion is the intrapelvic rupture of the urethra. Attention has been drawn to this by Edward Deanesly in a most instructive paper. Here the prostatic urethra is torn through immediately above the triangular ligament, the injury being caused usually by fracture of the pelvis, though in one of Deanesly's cases there was no fracture of the pelvis, the injury in this case being a lateral compression of the pelvis without fracture in a boy of fourteen years.

The importance of this injury lies in the ease with which it may be overlooked, and the awkward and dangerous consequences which such oversight may entail. The urine will collect in the prevesical space, and a catheter may readily be passed *per urethram* into the prevesical space, in which case it may be thought to be in the bladder. The train of fresh fallacies arising out of this one may be readily imagined.

As to the consequences, the chief one is this, that the time when it would have been possible to restore the urethral passage is allowed to pass, and the patient's condition becomes one of extreme misery, difficult to alleviate, as in a case reported by Gilbert Barling,[2] where he successfully implanted the ureters into the colon in order to cure a chronic vesical fistula following a fractured pelvis.

The disastrous consequences of this injury will be

[1] *Lancet*, Jan. 12, 1907, p. 81.
[2] *B. M. J.*, Jan. 19, 1907, p. 124.

avoided only by a recognition of the fact of its occurrence, and this is the chief point which I desire to emphasise.

Strictures and Catheters

One of the commonest mistakes in the whole of surgery is to diagnose a stricture where no stricture exists. *The real obstruction in some cases is the compressor* urethræ muscle, which acts the sentinel and objects to the passage of foreign bodies into the bladder. If the urethra be *inflamed* and *over-sensitive, spasm* of the compressor urethræ muscle is less easily avoided than if the urethra be healthy. Cold, hard catheters, lubricated with irritant applications and roughly passed, are sure to meet with determined resistance on the part of the compressor urethræ muscle. If the surgeon continues to increase his thrust and the muscle is strong enough to resist him, which is often the case, he will *force the catheter through the wall of the urethra.* The resulting wound may afterwards become the site of a stricture; while if his cleanliness is on a level with his clumsiness, a periurethral abscess may form with a resulting perineal fistula, and this I have known to happen with very sad consequences to both the people concerned.

To avoid the long train of troubles that may follow a mistaken *diagnosis,* we *should, when confronted* with a patient who has inability to empty his bladder, com mence our investigation by attempting to pass a full-size, soft, rubber catheter, well warmed and lubricated with some unirritating substance—liquid paraffin, for

example; and we must be careful to avoid setting up muscular spasm by any jerky, impatient efforts. The catheter must be coaxed rather than thrust along the urethra. With the observance of these precautions many a supposed stricture will vanish and the cause of the patient's disability will be found to lie in his nervous system, his prostate, or in some other lesion beyond the urethra itself.

"This man has a stricture (urethral), and I cannot get in the smallest bougie," so runs a note which I received a week ago. As a matter of fact, a soft rubber catheter of full size was made to enter his bladder with the greatest ease.

Only when soft catheters have failed should metal ones be employed, and of these not the ones of small calibre. I think it was Sir William Thomson who remarked that a No. 1 metal catheter was the most dangerous instrument in the whole surgery; probably no one of experience will find much fault with the statement.

It has been said in favour of a metal catheter that the surgeon always knows where the end of it is—a most dangerous and fallacious argument, for even if we do know exactly where the end of the instrument is, we cannot know so exactly the whereabouts of the urethra as to be sure we shall not cause perforation of its wall.

External Urethrotomy

Easy as it is to perform perineal urethrotomy on the dead body, it is often not at all easy to repeat the

performance in the operation theatre. In the main there are two sources of difficulty. The one is this, that the patient with a deeply seated stricture requiring a urethrotomy more often than not already has had efforts bestowed upon him to pass a catheter, with the result that one or more false passages are present. Into these by-ways the urethral sound travels instead of passing along the main road. The surgeon cuts down upon the sound and misses the urethra. It may be that he fails to realise that the sound is in a false passage, in which case he may fail to find the urethra at all. I have known this to happen; the surgeon gave up after a long attempt, not having found the urethra, and informed the patient's wife that it was impossible to give her husband relief by an operation.

Suppose there is no false passage and that the surgeon passes a sound down to the stricture, cuts through to it, and makes the sound protrude into the wound. If he be inexperienced, or careless, or deficient in anatomical knowledge, he may find another difficulty here. There is a thick fibrous sheath enclosing the urethra and the bulb. He may mistake this for the wall of the urethra itself, and waste his time and cause much laceration of the periurethral structures, which are very vascular, in a fruitless endeavour to introduce an instrument into the bladder. This is an exceedingly common error.

Before attempting to introduce an instrument into the bladder the surgeon should make quite sure that he has opened the urethra. He should see the mucous membrane, and he should pass a fine suture through

each edge of the divided urethra so that he shall not miss his way. Having once made sure of the mucous membrane, he should not lose sight of it when he divides the stricture. This, I think, may be more difficult than it sounds, but it is the right guide.

If he cannot follow the mucous membrane through the stricture to the dilatation which is to be expected on the proximal side, then he should cut down through the bulb, keeping most carefully in the mid-line, and he can hardly fail to find the urethra here, where it is almost certain to be dilated owing to the distal obstruction caused by the stricture.

Circumcision

As an operation perhaps circumcision is the worst performed of any which we do. We are careless about it, and in this way we abuse Nature's benevolence, for she is very kind in giving good results after bad operations in this particular instance.

An unpleasant accident is in snipping off the foreskin to remove a small portion of the glans penis at the meatus. This may require a great deal of inconvenient and troublesome after-treatment in order to avoid the formation of a stricture.

I have seen too much skin removed, so that the penis was flayed; and I have seen too little removed, so that the phimosis recurred, and the operation had to be repeated.

In one instance an inexperienced operator, in his determination to remove the entire foreskin, invaginated

on account of cystitis or for other reason, the bladder cannot be made to hold much fluid, or if the peritoneal fold extends downward in front of the bladder to an unusual distance, a very little manipulation will suffice to push up the peritoneum to a safe level. The peritoneal fold can be seen, recognised, and handled.

The other fault is merely to puncture the bladder with the knife. This allows the fluid to escape; the bladder contracts and the puncture may then be difficult to find. The knife ought to be plunged into the bladder, a downward cut made, and one or two fingers at once inserted; or the cut edges of the bladder should be immediately picked up and retained with forceps.

Lithotrity

A few years ago there was a discussion in surgical circles concerning the respective merits of lithotrity and supra-pubic cystotomy. Now supra-pubic cystotomy is such a straightforward and successful procedure that the general surgeon should have no desire to practise the alternative. If he does so he will be *seeking* and finding trouble. He will damage the bladder wall, fail to get rid of the calculus, or perhaps, though everything has gone off surprisingly well, the patient will shortly again be troubled with vesical calculus owing to a fragment having been left behind. Indeed, I have known a surgeon, more enterprising than wise, proceed to attempt lithotrity when the bladder itself was already so badly infected that supra-pubic cystotomy was indicated for the treatment of the sepsis alone.

It is not justifiable for a novice to practise lithotrity, n the very high morbidity risk which the operation ies in hands that lack experience, unless as a prelude he treatment of great numbers of patients with stone he bladder. The operation is one for the specialists for them alone.

An easy and satisfactory method of draining the lder is by means of a self-retaining catheter introduced ough a supra-pubic puncture made by the instrument gned by Sir Patrick Manson for draining hepatic cesses.

Enlarged Prostate

Concerning the diagnosis of prostatic enlargements re is a certain amount to be said. In the first place, nay be erroneous to assume, because a middle-aged elderly man has retention of urine, while a full-sized heter can be passed into his bladder, that therefore has an enlarged prostate. I have known of two ances in which such an assumption was made the is of operative interference and no prostatic enlarge- nt or other urinary obstruction was found; the ients were afterwards found to be in an early stage paralytic dementia.

To diagnose prostatic enlargements additional dence beyond the mere fact of retention of urine required. Palpation *per rectum*, and the discovery residual urine, are two such additional points importance in support of a diagnosis of enlarged state.

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the penis to such an extent that when he had finished the scissors work there remained a crescentic wound upon the pubes while the penis itself remained intact. My advice in such an emergency would be to sew up the crescentic wound and to treat the phimosis merely by a dorsal incision through the prepuce.

Recurrence of phimosis after operation is commonly the result of an incomplete operation; that is to say, the foreskin has not been slit right up to the base of the glans. My own predilection is to unite the skin and mucous membrane at the point of this incision with a fine catgut suture so as to ensure against the possibility of recurrence.

Occasionally it happens that the foreskin is adherent to the glans, and in peeling back the former some of the epithelial covering of the glans is removed. It is well, if this occurs, to cover the denuded glans with sterile vaseline in order to prevent the dressings from adhering. This partial denudation of the glans is sometimes unavoidable, and unless the raw surface be protected by a coat of vaseline or other sterile ointment some degree of ulceration is very apt to ensue, or the remains of the prepuce may become adherent and permanently fixed to the surface of the glans.

A prolonged convalescence of the circumcision wound is not infrequently the result of division of the frænum, at which spot chronic and troublesome ulceration may come about. It is a good rule to avoid dividing the frænum in all cases in adults and in most cases in infants —though the rule may often be broken in these.

Several babies have died from hæmorrhage after circumcision. Therefore mothers should be warned and instructed to seek help immediately if the wound bleeds, and the operator should be prepared at once to seize and tie the bleeding vessel, refraining from all tentative measures such as renewed applications of Friar's Balsam in the too often vain hope that the hæmorrhage will automatically stop.

Because cleanliness is difficult in these cases, there is no reason to be carelessly dirty about the operation or the after care of the wound. I have known a fatal septicæmia to follow circumcision, and I have seen also acute suppuration of the inguinal lymphatic glands as a result—this too in the only child of well-to-do people.

In another baby a primary syphilitic chancre developed on the penis. The operation wound had been dressed by a midwife who was found to be luetic.

I cannot relinquish the subject of circumcision without mentioning a curious case. An elderly man came to me for advice about a sore on his penis. He had a phimosis, and the foreskin had never been retracted. Some months previously he noticed some irritation at the end of the penis, and this was accompanied by a purulent discharge. He consulted a doctor, who told him he had gonorrhœa. This he declared was impossible, but the cynical doctor only laughed at him. In the course of a few months the patient once again visited the doctor. There was now a hard flat dusky swelling in the foreskin about three-quarters of an inch in diameter, and it was just beginning to ulcerate in the centre.

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Any fool can make an excuse, and in any event excuses are ready enough to be found There was an excuse, perhaps more than one, for the surgeon who removed a large ovarian cyst from a patient and some years later was asked by the same patient to remove a tumour of her remaining ovary The surgeon agreed to perform the operation, during which he pushed a large ovarian trocar into the large swelling which arose out of the patient's pelvis Failing to empty the "cyst" in this way, he withdrew the trocar and thrust it into another part; again with failure He repeated the

attempt a third time before he realised that the supposed cyst was in fact a pregnant uterus. The operation terminated with a hysterectomy.

It requires no recondite knowledge to say that a patient ought not to have a distended bladder when submitted to laparotomy; or to say that pregnancy should be recognised at the proper time, which is not when the abdomen is open; unhappily it is easy to commit grave sins of omission with regard to these doctrines.

The operation of ovariotomy is an easy one provided that there are no adhesions between the tumour and the surrounding organs. The abdomen is opened, the tumour is delivered through the opening, the pedicle is tied, divided, covered in by peritoneum, and the abdomen is sewn up again. And yet, simple as this seems to be, there are one or two errors that are sometimes made. A common practice has been, when dealing with a large cyst, to reduce its bulk before bringing it to the surface, by drawing off some of the contained fluid with the aid of a large trocar and canula. The object of this manœuvre is to so reduce the size of the tumour that it may be withdrawn through a smaller wound in the abdominal wall than otherwise would be feasible. Nevertheless, the practice is objectionable, because it is impossible to ensure that none of the contents of the opened cyst shall escape into the abdomen. Diffuse carcinomata or papillomata of the peritoneum may be consequences of such escape, and even diffuse dermoid growths in the abdomen have resulted; while the risk of peritonitis is a concomitant of opening the cyst

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Cysts of the Broad Ligament

These cysts are removed by enucleation. The principle to be followed, as in other enucleations, is to keep the operating finger continually in immediate contact with the structure which is to be removed. In this way unnecessary laceration of surrounding tissues and excessive hæmorrhage will be avoided, and the danger of injury to the ureter will be obviated. And it is well to bear in mind that the ureter may be in direct contact with the wall of a broad-ligament cyst.

Carcinoma of the Ovary

A frequent occurrence is the growth of a carcinoma in the ovary as a secondary deposit, the primary cancer affecting some other abdominal organ. The explanation of this is that cancer cells become detached from their former abode, and gravitating downward to the lowest part of the peritoneal cavity, which is the pouch of Douglas, take root therein. It behoves every surgeon to keep this fact in mind, and when opening the abdomen for the removal of a cancerous ovary to be on the look-out for a primary growth of the stomach, gall-bladder, large intestine, or some other abdominal organ. For the discovery of such a primary growth may lead to a reconsideration of the desirability of performing ovariotomy. Of course, it may be well to remove the ovarian growth, if the procedure is an easy one, merely as a palliative; for these ovarian tumours grow rapidly

if the contents happen to be infected. Plainly it is better that the patient should have a long abdominal incision than that she should be subjected to such hazards. Although, of course, there still are to be seen now and then those enormous, neglected ovarian cysts for the treatment of which a trocar is more than justifiable.

A *remote complication* of ovariotomy which is not unknown is intestinal obstruction, brought about by the adhesion of a portion of intestine or omentum to the ovarian pedicle. In every case, therefore, steps must be taken to forestall such an evil consequence by covering the raw surface of the stump with peritoneum. With thin pedicles there is no difficulty in carrying out this detail. But with a thick one it is advisable to incise the peritoneum around it and strip this back for a short distance; the pedicle is then transfixed, tied and cut, and the peritoneum is sutured over it so as to bury the raw surface.

An interesting fact is that pregnancy has been known *to occur after double ovariotomy*, the explanation being that the ovary is not such a discrete and circumscribed organ as some suppose and diagrams in the text-books depict, and in consequence small portions of the organ are apt to survive in the pedicle after an ovariotomy as ordinarily performed.

This fact should be observed and utilised by the surgeon, who, by the deliberate retention of some of the ovarian tissue in the pedicle during an ovariotomy, may secure his younger patients from some of the harassing effects of an artificial and premature menopause.

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and attain a large size. But if the tumour would be difficult to extract on account of invasion of contiguous organs, the completion of ovariotomy in such circumstances would be hardly justifiable.

Salpingitis

The two chief dangers incurred in the removal of inflamed Fallopian tubes are injury to the bowel and dissemination of sepsis. Shock is an added danger if the operation be unduly prolonged. With regard to the dissemination of sepsis in the general peritoneal cavity, this is unlikely to occur in cases of long standing, but it is a real danger if the operation be done in the acute stage or during a period of exacerbation of symptoms. To avoid the danger, the rest of the abdominal cavity should be well packed off from the area of operation, and any pus escaping into the pelvis should be swabbed up at once, the pelvis being kept as dry as possible throughout. Subsequent drainage is usually uncalled for, but some experience is required in order to know which cases ought to be drained. The rule should be to drain if in doubt. Sometimes there is much oozing from the division of adhesions, and these cases will require drainage. A rubber tube will be sufficient, and it should be removed at the end of forty-eight hours. Drainage tubes retained for a longer period act as foreign bodies, that is to say, as agitators who form the rallying ground for any evilly disposed germs that happen to be present.

Injury to the rectum may be excusable, but with the

possibility in his mind the surgeon will keep an active look-out for it and adopt remedial measures. The chief danger comes when a wound of the rectum is overlooked, as in a case referred to by Bland Sutton.[1] In this instance the surgeon in removing a pyosalpinx inadvertently tore a hole in the rectum. Being unaware of the accident, he ordered ten ounces of saline solution to be injected into the bowel a few hours after the operation. This fluid passed through the rent into the pelvis with fatal consequences.

Sinuses of a most intractable kind may follow the operation of removal of septic uterine appendages. Like sinuses after other abdominal operations, their source is most commonly one or more infected ligatures. These ligatures, lying as they do in the depths of the pelvis, are not readily extruded, and so the sinus may persist for years and give rise to much inconvenience and suffering. The complication may be avoided by using the finest catgut ligatures compatible with safety. Although there are objections to catgut as a material for ligatures, this material should always be used in septic operations, such as the removal of infected tubes, because it becomes absorbed, and so does not originate long-enduring sinuses.

Correct surgery will often demand the removal of the uterus as well as the infected tubes, because endometritis is a frequent concomitant to salpingitis. Moreover, the uterus, if left behind, is liable to become

[1] "A System of Operative Surgery," edited by F. F. Burghard, 1909, Vol. IV. p. 24.

retroverted and fixed in that position by posterior adhesions.

Extra-uterine Gestation

When an extra-uterine gestation sac ruptures into the peritoneal cavity the hæmorrhage which ensues may be so rapid and profuse as to cause symptoms which are not likely to be misunderstood. But this is not always the case. The initial hæmorrhage may not be sufficiently copious to render the diagnosis easy and manifest, and in these cases misinterpretation of the symptoms may come about. On the one hand, the condition may be mistaken for some other acute abdominal crisis—perforated gastric ulcer, for example—with the result that the incision is misplaced and the operation unduly prolonged. On the other hand, the case may be regarded as one of abortion. And in connection with these errors it is to be noted that a large amount of blood may be free in the pelvis without being detectable by careful bimanual palpation, although a tender lump can, as a rule, be recognised alongside the uterus. The patient's temperature sometimes offers a clue which is a help when considered together with the other features. For with a recent collection of blood in the peritoneal cavity there is almost sure to be pyrexia unless the patient is in a stage of collapse; whereas the temperature is not raised in clean cases of abortion. The onset and progress of pain also are different in the two conditions. In the one the onset is sudden and the pain is continuous, while in the other

the commencement is gradual and the pain is intermittent. Moreover, in contrast with that which is found in abortion, the *os uteri* in extra-uterine pregnancy is not patulous nor markedly soft.

It is hardly necessary to remark that rapid operating is required in a case of ruptured ectopic gestation sac. The surgeon's first endeavour, as soon as the abdomen has been opened, must be to check the bleeding. This should be done at once by placing one clamp upon the tubo-ovarian ligament in which runs the ovarian artery, and another upon the uterine portion of the broad ligament in which course the terminal branches of the uterine artery.

The uterine adnexa on the side opposite to the lesion also should be examined, for the second tube may be gravid too, or there may be some other lesion—a hydrosalpinx, for example—whose existence it is well to verify even though it be regarded as inexpedient, owing to the serious condition of the patient, to deal with it at the same time.

Transfusion of blood is a remedial measure that must not be lost to sight, for it may be the means of saving life when other measures would fail in some of the more acute cases of hæmorrhage from tubal abortion or rupture of an ectopic pregnancy sac.

THE UTERUS

The Passage of a Sound into the uterus for purposes of examination has been responsible for some unfortunate occurrences and a few disasters. Perhaps the introduc-

tion of sepsis is the greatest danger connected with this procedure. A patient went to her doctor complaining of certain symptoms which led him to examine her uterus with a sound. This little investigation was followed by peritonitis, from which the patient nearly lost her life.

Another misadventure is perforation of the uterus. A friend of mine was about to curette a uterus on account of subinvolution due to retained membrane or placenta. He commenced by passing in a sound, but was surprised at the distance through which the instrument travelled. On palpation of the abdomen he could feel the tip of the sound pressing against the abdominal parietes. Although but little force had been used, he had perforated the uterus. The fact is that for a while after abortion or labour the uterine wall is soft, and may be penetrated easily by the sound, dilator, or curette.

The same is true of carcinoma of the uterus, and in this case the accident is peculiarly unfortunate as it is liable to cause dissemination of the cancer in the peritoneum.

Inserting a sound into a pregnant uterus is another piece of bad work which needs to be chronicled. The mere mention of these accidents is sufficient; the way of their avoidance is clear.

It is hardly necessary in these days, one would have thought, to state that a sound should never be passed without the help of direct vision. For in this manner only can septic contamination be eschewed. Nevertheless, the axiom requires restatement, for the old practice

appears to be not yet extinct judging by the following recent experience. A medical practitioner sent a patient into hospital with a diagnosis of uterine fibroids. In his note he said he had used a sound and had found that it passed four and a half inches into the uterus. As a matter of fact the patient had previously undergone hysterectomy, and into what channel the sound had passed remains a mystery.

A curious and rare accident with the uterine sound was its passage into an interstitial ectopic gestation sac, causing copious hæmorrhage and collapse of the patient.[1]

Dilatation and Curettage.—When dilating a cervix it is quite a common occurrence to tear the cervix. These lacerations may give trouble, not only by the hæmorrhage and sepsis that ensue, but by becoming the seat of cancer later on. At least one must suppose this to be a danger knowing what we do of the conditions which precede malignant disease; and whether the supposition be justified by fact or not, we cannot but regard laceration of the cervix as bad surgery. The cause of the tear is an endeavour by forcible and rapid means to achieve more by the dilators then they are able to perform when used in this manner. If for any reason it is desirable to secure a passage larger than can be secured at one sitting without laceration of the cervix, a tent should be inserted twelve hours or so before the operation. And when a tent is used strong tape or silk should be attached to it beforehand, because the end of the tent which projects into the uterus will swell more than the

[1] *Brit. Med. Jour.*, 1907, Vol. II. p. 1270.

portion which lies within the cervix, and it may require a hard pull to overcome this obstacle to its extraction.

As to the expediency in any particular case of *dilating the cervix sufficiently to allow digital examination of the interior of the uterus*, this must be left to the judgment of individual surgeons. But it is well to *bear in mind that the blind use of the curette allows of* many fallacies, and for this reason it is often of advantage to be able to examine the interior of the uterus with *the finger*. A case, for example, has been recorded [1] in which the cervix was dilated and the uterus curetted on account of hyperemesis. Nevertheless, pregnancy continued to the full term. A digital examination in this case almost surely would have revealed the continued presence of the ovum.

In another case [2] the uterus was curetted thoroughly for five minutes. The gynæcologist then explored the uterine cavity with his finger and found a three-and-a-half months' fœtus with placenta complete.

True it is that both finger and curette may fail to discover a mass of placental tissue which is present in the uterus, but the oversight is less likely to occur if both these means of examination are employed than if the curette alone be used. As a matter of fact, most of the cases in which a digital examination is desirable are instances of abortion, and in these it will often be easy by rapid dilatation alone to make room for the finger.

Curettage.—A good deal of mischief has been done

[1] *Brit. Med. Jour.*, 1906, Vol. II. p 318.
[2] *Loc. cit*

with uterine curettes, and perforations of the uterus have been numerous. Fortunately, no recognisable ill results have followed in many of these cases. In others, no doubt, septic or carcinomatous material has been carried into the peritoneal cavity. The following case has features which are especially tragic. A patient,[1] supposed to be aborting, was curetted. Subsequently she was admitted to hospital with 72 inches of small intestine protruding through the cervix. As in perforation with the sound, so with the curette, the accident is most likely to happen in cases of pregnancy and malignant disease, for in these conditions the resistance of the uterine wall is diminished.

Sometimes[2] the interior of the uterus is scraped so thoroughly and with such vigour as to bring about complete and permanent amenorrhœa. Indeed, quite recently I was consulted by a married woman aged thirty-one. She stated that three years previously she had been curetted on account of severe and persistent menorrhagia. Since the operation the patient had suffered from complete amenorrhœa. The uterus was not enlarged. She complained of severe headaches and of never feeling really well.

I have been called upon to perform hysterectomy in a case of hæmatometra which was sequent upon and the result of curettage. Subsequent examination of the specimen showed complete atresia of the cervix at the level of the internal os. Further, I am aware of a case

[1] *Proc. Roy. Soc. Med.*, June 1909, p. 291.
[2] Prof. Kidd, *Brit. Med. Jour.*, 1909, Vol. II. p. 1028.

in which a Cæsarean section was performed in order to deliver a full-term child which could not be born in the normal manner owing to a complete failure of the cervix to dilate. The patient gave a history of having been curetted "several times."

To avoid these errors a blunt curette should be used in all cases where it can be relied upon to be effective, as in the removal of retained products of conception; and *if a sharp curette is regarded as necessary in any particular case, it should be used with the greatest gentleness and care. In all cases vigorous curetting is* to be looked upon with disapproval; vigour and thoroughness are not commensurate terms in this respect. And especially careful must we be not to exterminate the mucous lining of the cervix, which to the onlooker sometimes appears to be the object of certain surgeons while performing the operation. In the majority of instances it is the endometrium of the body of the uterus *which calls most loudly for treatment with the curette.*

I have noticed on several occasions when performing laparotomy upon patients who had recently undergone curettage the presence of adhesions or of organising lymph on the surface of the uterus. These must be looked upon as indications of a fairly severe inflammatory process set up in the uterine wall by the curetting. Possibly the stirring up of *sepsis has been responsible in some cases, and perhaps* the reprehensible practice of swabbing out the cavity of the uterus with strong chemicals is accountable in others.

There is one more source of trouble and danger in connection with the use of curettes that should be mentioned. Patients with chronic inflammatory conditions of the Fallopian tubes are apt to suffer from excessive loss during the menstrual periods. This or some other concomitant circumstances may lead the doctor to recommend curettage. If this be done there is a real danger of lighting up acute sepsis in the uterine adnexa and pelvic peritoneum. Circumspection is therefore required before advising a patient to undergo curettage in the presence of dormant or chronic infective conditions of the uterine adnexa.

Hysterectomy

The first step, after the abdomen has been opened, in an operation for removal of an enlarged uterus, is to deliver the organ through the wound. I have known a surgeon to endeavour to perform hysterectomy on account of fibroids without carrying out this essential manœuvre. Profuse hæmorrhage took place from an inaccessible vessel, the operation was not completed, and the patient died. In order to effect its delivery a vulsellum forceps applied to the fundus uteri is sometimes employed. This is not a good practice, for by its means malignant cells and possibly septic material also may be given an avenue of escape to the peritoneum. In the first place, the hand should be used to bring the uterus out of the pelvis, and if further traction be required, it should be applied by clamps applied to the broad ligaments on each side of the uterus.

a subtotal hysterectomy for fibroids, was perfectly simple and straightforward. It was followed, however, by some loss of bright blood by the vagina. The loss was not copious at first, and I felt cocksure that it did not come from any large vessel. However, I was sent for in a hurry a few days later, because the hæmorrhage had become alarming. With the patient anæsthetised, I found that the remaining stump of the cervix was widely dilated and filled with protruding clot. Clearing this out, I applied clamps to the stumps of the uterine arteries. But one of the clamps came away and brought with it the stump of the left uterine artery. The ligature was in place and had clearly secured the vessel efficiently. But at the spot—one inch proximal to the ligature—where the vessel had torn away its coats were infiltrated with blood and showed unmistakably that they had been injured at the time of the operation. I have hardly any doubt that in suturing together the anterior and posterior peritoneal flaps I had wounded the artery with the needle, and possibly included part of its wall in the suture. Happily no more hæmorrhage occurred and the patient made a good recovery.

Injury of the Ureter during Gynæcological Operations

The ureter is exposed to danger in a variety of surgical procedures. During operations for cystocele, while the bladder is being separated from the vaginal mucous membrane and the remains of the pelvic fascia, or while the fascia is being sutured, the lower end of a

ureter may be wounded. But the danger is most common in connection with extirpation of the uterus for malignant disease; though it is present also in other intra-pelvic operations and especially so if the ordinary relationships of the anatomical structures have become changed, as, for example, in a case of cervical fibroid where the ureter may be in close contact with the enlarged cervix instead of being separated from it by a space of about three-quarters of an inch. Cysts of the broad ligament, too, may actually impinge upon the ureter and so bring it into the danger zone.

To minimise the chances of injuring the ureter it is important to know exactly where this structure lies; and if the case is one in which there is any risk of an accident, such as a Wertheim's operation for extirpation of a cancerous uterus or the removal of a cervical fibroid, to define and expose fully the ureter at an early stage of the operation.

The most frequent site of injury is where the ureter is crossed by the uterine vessels, but it may also be included in a ligature applied to the suspensory ligament of the ovary for the purpose of securing the ovarian artery if the spot selected be above the external iliac vessels; for at this level the ovarian artery and ureter are in close relationship.

If, in the course of an operation, the surgeon recognises that he has divided a ureter he may do one of three things: he may perform an anastomosis which is best done by invaginating the upper end into the lower and fixing it there by sutures; or, if a segment of ureter

out to which side of the patient the baby's back is turned, and make our incision through the corresponding rectal sheath. Having opened the abdomen, we should then ascertain the exact posture of the uterus so as to make our incision as nearly as possible in the mid-line of its anterior surface.

The surgeon who is in a hurry is a dangerous man at this stage. He is apt to cut straight through whatever part of the uterus presents through the laparotomy wound, and in doing so may make his incision close to the uterine vessels or even may cut these across.

Rupture of the uterus during a subsequent pregnancy or labour is a real and dangerous sequel to Cæsarean section. But the danger can be avoided almost certainly by making the incision into the uterus fairly low down—the upper third of the organ should be kept intact—and by careful suturing after delivery. Here again I think undue haste is inimical to success; and whenever I hear a man boast that he takes only five minutes to perform Cæsarean section, I feel sure that his case records will hold a big percentage of subsequent uterine ruptures and ventral hernias. Where is the necessity to save three or even five minutes in these operations?

Another condition that probably increases the liability to subsequent rupture of the uterus by interfering with the formation of a good sound scar is septic infection; and this is not likely to come about in the case of a premeditated Cæsarean section.

On one occasion, whilst performing the operation upon a patient in whom labour had not yet commenced

though the full time of gestation had been completed, a notion, which I had just previously imbibed from the columns of the *British Medical Journal*, suddenly occurred to me, namely, to thrust a pack down through the uterus and into the vagina before sewing up the uterus. Accordingly, I pushed down a pack moistened with a solution of hot biniodide of mercury, and closed the uterus and the abdominal wound. But when I came to remove the pack from the vagina it was not there. The fact was, labour not having commenced, the pack remained incarcerated in the lower part of the uterus, and to remove it I had to get the patient in the lithotomy position and dilate the cervix. Although no harm came of it, this absurd little mistake shows the danger of putting into practice the ideas which arise with sudden inspiration from undigested literature.

Some Awkward Cases connected with Pregnancy

A surgeon whom I know was consulted by a young woman, who stated that she had been married for eighteen months without becoming pregnant. She further stated that it was a matter of great importance that she should have a son. She had been frequently separated at short intervals from her husband. It was agreed that she should go into a nursing home for a thorough uterine examination with dilatation of the cervix. This was done, no abnormality being discovered in the pelvic organs. The cervix was dilated, a curette was inserted and brought away an early ovum !

On another occasion a surgeon treated a lady for incomplete abortion. Her husband was away at the time, and on his return paid a visit to the nursing home to thank the nurses for their kindness to his wife and to inquire as to the nature of her illness. He was told she had miscarried, and was referred to the surgeon for any further information. To him he came, thanked him for attending his wife in her miscarriage, and went away. The wretched surgeon, who had suspected nothing amiss, found himself a little later in the extremely unpleasant position of being called upon to give evidence in a suit for divorce. The husband at the time of his wife's illness had been separated from her for a year.

These cases are quoted merely to show what extreme caution must be exercised whenever women, especially if they be strangers, seek advice upon gynæcological matters.

Pregnancy Overlooked

Failure to recognise pregnancy is a fertile source of error in surgery. A striking instance has been quoted already (p. 254). In view of the importance of the subject others may be quoted. I was present one day when a surgeon was performing a hysterectomy upon a childless married woman of forty. The abdomen was opened and the enlarged uterus was removed. The operation having been completed and the dressings applied, the surgeon proceeded to open and examine the uterus. He was in the act of exclaiming with triumph, "As I thought—a carcinoma of the body," when one

more cut passed completely through the supposed carcinoma—which was placental tissue—and out popped a fœtus. As bad luck would have it he was surrounded by a group of interested onlookers at the time.

Many other ill happenings arising from the oversight of pregnancy could be quoted, some of them truly tragic in their consequences. But those I have mentioned will suffice. They are due to a combination of causes. Patients may give information which is misleading, circumstances may render diagnosis a matter of some difficulty; but the chief sources are incomplete examination of the patient and too great a hurry in submitting the case to operation. Investigation of the mammæ for the presence of secretion, appreciation of the significance of a soft cervix and a uterine souffle audible with the stethoscope, the recognition of fœtal parts and movements and of alternating hardness and softness of the tumour due to silent uterine contractions, all are affairs which must be taken into consideration. Furthermore, in cases of uncertainty, time may be relied upon to clear the matter of any doubt which may have remained.

CHAPTER XXIII

THE RECTUM

Injuries.—The rectum is said to have been perforated by the surgeon's finger during an examination, and although it is difficult to believe that such a thing could happen with a healthy bowel, the matter may be worth mentioning. The sigmoidoscope certainly has been responsible for some perforations, and so also has an enema tube. In the hands of an unskilful nurse the rigid clyster pipe is a dangerous weapon, and this type of instrument should be abolished entirely, except perhaps as a museum specimen. A rubber tube is the proper appliance for the introduction of an enema. The rectum is not very sensitive, and undue pressure upon its walls may not cause an equivalent response of pain.

The following is a curious example of a gross rectal injury which was overlooked. The patient was a house decorator, and whilst at work on a platform a few feet from the ground, he overbalanced. A barrow with upturned handle was behind him, and as he landed on the ground the handle of the barrow struck him between the legs. He went to a hospital which was close by. The house-surgeon who saw him did not suspect any grave injury, and after keeping him for a short while

under observation told him he could go home. On his way, however, the patient began to feel sick and to have pain in the abdomen, so his friends took him to another hospital. There again no severe injury was suspected, and once more he was recommended to go home.

On the following day he was admitted to a third hospital nearly dying and with acute abdominal symptoms. Rectal examination did not reveal any external bruising or blood, nor could any lesion be discovered with the finger. As a matter of fact, he had an extensive laceration of the rectum with a free opening into the peritoneal cavity. At the ensuing inquest the coroner, who happened to be somewhat of a bully, showed little mercy to the poor house-surgeon who had turned the man away from the hospital in the first instance.

Prolapsus Ani.—A case has been mentioned in another chapter where prolapse of the anal mucous membrane in an infant gave rise to symptoms which were attributed in error to intussusception. A bilateral prolapse might be misregarded as a prolapse of the rectum, though the differential diagnosis as a rule is easy enough, for the protrusion of the anal mucous membrane does not form a cylindrical tumour. The two halves slip down separately, each being held up at the anterior and posterior extremities, so that there is a median cleft between them; whereas a prolapsed rectum forms a cylindrical projection with a gutter completely surrounding it. Probably there have been many unrecorded disasters in the treatment of *prolapse*

of the rectum arising out of mistaken diagnoses or from a failure to appreciate that its peritoneal covering accompanies the extruded portion of intestine I have known a doctor set out to ligate what he supposed to be a rectal polypus The only thing that deterred him from effecting his purpose was a sudden and large increase in the size of the tumour in the middle of the operation Startled by this, he summoned a colleague to his aid The mass was a prolapsed rectum

Hæmorrhoids —Before advising a patient to have an operation performed for the removal of piles, we should give a thought to the question—" Why is the patient troubled with hæmorrhoids ? " If we do not indulge ourselves with this speculation we may possibly advise a pregnant woman to undergo an operation for their removal We may fall into other errors also I have seen a man with cirrhosis of the liver who had recently been operated upon for the cure of piles I think he had passed through considerable peril, for anæsthetics are dangerous to those with cirrhotic livers On another occasion a patient underwent a pile operation A few days later persistent diarrhœa set in , and eventually this affliction led to a digital examination which disclosed an ulcerated and extensive carcinoma of the rectum The patient died shortly afterwards

Operations for Piles —A common custom is to stretch the anal sphincter, as the first step in an operation for the cure of hæmorrhoids Whether this procedure is or is not necessary may be open to argument, but it is unquestionable that any dilatation that is carried

out must be done with discretion and moderation, because there is a real danger of putting the sphincters permanently out of action if too much force be used. The danger is not an imaginary one. Even while writing this chapter I have been consulted by a lady who had been operated upon seven years previously for the relief of hæmorrhoids. Loss of sphincteric control followed. A second operation had been done after an interval of a year in the hope of effecting a remedy, but this had failed in its object. And in spite of skilful and prolonged treatment by electricity and special exercises, the poor lady has never recovered control of the bowel to this day, and has been obliged to live a half-invalid existence with perpetual harassment.

After the operation hæmorrhage may give trouble, and may prove to be an awkward complication if not detected before the patient has left the operation table.

Unless a tube has been inserted into the rectum the bleeding will be concealed, because the sphincters will prevent blood from escaping into the dressings and becoming evident. In this way hæmorrhage can continue until the patient has become blanched, and even then may be overlooked. To avoid this sequel, careful inspection is required before the patient leaves the operation table in order to see that no ligature has slipped, and that no spurting vessel remains unsecured. An additional precaution is to insert a rubber tube into the rectum, leaving it there for twenty-four or forty-eight hours. The tube will not only help to prevent hæmorrhage

by the pressure it exerts, but if bleeding does occur it will speedily be detected by the escape of blood through the tube. Moreover, it is perhaps of help in allowing the passage of flatus. The tube must, of course, be prevented from disappearing altogether into the rectum; by transfixing it with a safety pin this purpose will be secured.

In one case after an operation for hæmorrhoids there was troublesome, slight, but continuous venous oozing, which continued for two or three days, at the end of which time the doctor made a digital examination of the bowel, where he found a large scybalous mass; removal of this was followed by cessation of the bleeding. This case illustrates what ought perhaps to have been mentioned earlier, namely, the necessity for a proper preparation of the patient before performing a surgical operation on the rectum.

Anal Stricture.—Whatever particular method of operating be employed, if too large an area of mucous membrane be removed, a stricture of the anus is apt to result. When once established, it is not easy to find a remedy, and the condition is a most distressing one. Attention, therefore, should be directed to avoidance of the trouble. Two preventive measures must be considered. The first is the obvious one of conserving sufficient mucous membrane. The second consists of a digital examination a fortnight after the operation. This is not too late for the detection and prevention of a commencing stricture, while examination at an earlier stage is apt to be painful.

Fistula in Ano.—As in the operation for hæmorrhoids, so in treating a fistula it is customary to stretch the sphincter muscles. Probably this is not necessary; yet the practice is in vogue, and therefore it is well to refer again to the desirability of moderation in order to avoid producing permanent functional disability. For some years I had under my care a lady who suffered from complete loss of sphincteric control of her rectum as the consequence of an operation for fistula. She used to take morphia in order to secure constipation, thus avoiding untimely rectal misadventures. In this case it is doubtful whether the paralysis was due to excessive stretching of the muscles or to the manner in which the fistula had been divided, but the former appeared to be the most probable.

When slitting open a fistula, care must be taken to cut through the external sphincter at right angles to the direction of its fibres; for if it be cut through obliquely it is apt to be rendered permanently weak and perhaps incompetent.

That this consequence has not been met with more often is probably due to the fact that the majority of fistulæ do not pass between the two sphincters, as used to be taught; the track commonly lies merely between the mucous membrane and the external sphincter. Nevertheless, it may pass between the two sphincters, and caution therefore is necessary.

Another important point in these operations is to avoid dividing the internal sphincter if a sinus happens to extend upwards in the perirectal tissues external to

this muscle, for if both the sphincters be divided the likelihood of causing loss of rectal control will be great Sometimes there are two external fistulous openings It is not to be assumed that these are due to two separate fistulæ To divide the sphincter in two places under this misapprehension would be a bad mistake, involving grave consequences In these cases there is almost certainly but one fistulous track passing between the internal and external sphincters This track should first be slit, and the other burrowings and ramifications, if there are any, may then be followed up and opened without again interfering with the external sphincter

One little mishap which may rob an operation for fistula of success is failure to pass the director exactly along the fistulous channel, with the result that the fistula is not completely laid open The error is to be avoided by gentleness in passing the director If the track is not quite straight and force be used, a false passage may be created

Fistulæ not uncommonly are tuberculous in origin, and this is always to be borne in mind, for it may lead to the discovery that the patient has tuberculosis of the lung Moreover, it indicates the advisability in any case of establishing suitable hygienic treatment

Carcinoma of the Rectum is not always a very malignant form of cancer, and operations would have a large measure of success if the condition could be diagnosed at an early period Only too often the disease is far advanced by the time the surgeon is consulted Men

in general practice, therefore, will do well to be perpetually alert in order to suspect and recognise the condition, and to remember that diarrhœa, or merely an increase in the number of daily evacuations, constipation, the passage of mucus with or without blood, a sense of incomplete evacuation of the bowel, or merely an uneasiness in the rectum, may, any of them, be due to cancer of the rectum. Hæmorrhoids rapidly increasing in size and effect, cachexia, "sciatica," intestinal obstruction are more commonly the results of a growth which already is far advanced.

Operations for cancer of the rectum may be considered in three divisions. In the first are those cases in which the affected segment of gut can be resected without interference with the anal sphincters, and the integrity of the tube can be restored by suturing together the two divided ends. These are the best cases and unhappily the rarest. Secondly, there are those in which the resection has to be accompanied by colotomy. And lastly, there are the advanced cases in which the growth cannot be removed, and in which a colotomy may or may not be required.

There is not space in this book to enter into the minutiæ of the various operations or to discuss the special indications which may be relied upon to guide us in our choice of methods. But it may not be out of place to make some general statements which are germane to the subject in hand

When a transcoccygeal excision is performed and the intregrity of the canal can be restored by suturing

together the two cut ends, it is essential to provide drainage of the wound; for not only is suppuration to be expected in every case, but owing to the extensive opening up of the connective tissue and to its looseness in this region, the infection may rapidly spread over a wide area unless the wound is well drained. As a matter of fact, in the majority of cases a fæcal fistula will come about, though it will close spontaneously in the course of time. Secondly, it may happen that, having removed the diseased portion of bowel and the contiguous tissues, it is found to be impossible to bring the upper segment down to meet the lower without undue tension, and all hope of restoring the integrity of the gut falls to the ground. There might be a temptation in such a case to be content with the formation of a sacral anus. This is to be avoided, for a colotomy is much to be preferred to a sacral anus from the point of view of the patient, and it will save him from the misery and dread of a second operation if the colotomy be performed at once.

The only other comment that need be made concerning these operations has reference to colotomy as a palliative operation in those cases in which the growth has advanced too far to permit of its removal. There is only one criterion by which we can decide whether to advise the patient to undergo colotomy or to have no operative treatment, and that is the patient's own comfort. There is no other reason for performing colotomy than to relieve some definite ill-convenience by a lesser one. And it follows that the disadvantage

from which the patient is suffering must be considerable before we are justified in recommending the formation of an artificial anus. The matter requires statement in this manner, for there is evidence that the balance is not always correctly struck.

be a better way of dealing with the mistakes of this section of surgery to describe the proper, modern principles to be observed, than to detail the defects of special methods which have had their vogue in the distant past and though moribund are not yet altogether defunct

Principles of Amputation

Amputation of the Correct Limb —To remove the wrong limb is obviously an error of the first magnitude Yet the mistake has been made and probably will be made again Not infrequently a patient is brought to hospital with severe injuries to both legs one of which requires amputation, and if the surgeon and his assistants are very weary it is possible that the wrong limb will be removed

Story has it that a certain celebrated surgeon, having in error removed the wrong leg in such a case, was then most anxious for the patient's sake to take off the other limb which was the seat of a severe compound fracture This the patient stoutly refused to allow His refusal was justified, for he recovered with a useful leg

Such a mistake is more likely to be made with injuries of the hand, in which case it is quite possible to remove the wrong finger unless the surgeon keeps himself wide awake

Amputation during Primary Shock —To amputate a limb on account of a severe injury before the stage of primary shock has passed away is to court disaster Resuscitation is the first requirement, and not until

reaction has set in must any operation be performed. One used to hear of patients being taken "straight to the theatre" on their arrival in hospital, and although such a practice is unthinkable nowadays, yet there still appears to be in some quarters a tendency toward too great a hurry and to allow the operation to encroach upon the period of primary shock.

Prevention of Loss of Blood.—The advisability of controlling the blood supply of the limb concerned throughout the course of an amputation would hardly seem to call for reference were it is not for one quite common shortcoming in connection therewith: namely, the discovery, when the tissues are cut through, that the tourniquet is not producing sufficient constriction to occlude the arteries. The fact is we need some sort of tourniquet that will register to our vision the amount of pressure which is being exerted on the tissues at any particular moment. Meanwhile, to be on the safe side, we must apply more than just enough force, and experience alone will tell us how much to use.

Again, he is a rash surgeon who dispenses with a tourniquet and trusts to digital compression of the main artery by an assistant whose duty in these circumstances may be difficult and exhausting and not entirely crowned with successful achievement, especially if there is much manipulation of the limb during the operation. I have seen a surgeon, who was relying upon this method of hæmostasis while amputating a leg above the middle, get into considerable difficulty over securing the tibial vessels. Every time the limb was moved there was a

disconcerting spurt of blood owing to the common femoral artery slipping from beneath the weary assistant's fingers. The consequences were a flurried operation, a serious loss of blood to the patient, and a loss of confidence in one another on the part of the surgeon and his helper.

Before leaving the subject of tourniquets it may be well to refer to the advisability of releasing the pressure before the flaps are sutured. Surgeons occasionally forget this little detail, with the result that bleeding takes place from some unobserved and unsecured vessel, and a hæmatoma develops beneath the flaps, to interfere with subsequent satisfactory healing.

How to fashion Flaps.—In the old days of unmitigated sepsis it was customary to make bulky flaps, to talk of "good covering for the bone," of "thin, poorly nourished flaps," and so forth. Such phrases should now be confined to the library shelves. It is no longer desirable after an amputation for the end of the bone to lie buried in a mass of scar tissue. Nor do flaps slough merely because they are thin. Of course, a thin flap may more easily than a thick one be unduly compressed by clumsy bandaging. But this should be avoided. The blood supply of the skin and superficial fascia is separate from that of the subjacent deep fascia and muscle; therefore the retention of bits of the latter does not assist in maintaining the nutrition of the skin flap. Moreover, the slices and lumps of muscle that one sometimes sees even nowadays folded over the end of the bone in the flap of an amputation merely become converted with the

course of time into scar tissue, which bears pressure badly, gives pain, and readily ulcerates. One of our chief aims, indeed, is to reduce the residual scar tissue to a minimum. For these reasons amputation flaps should consist of skin and superficial fascia alone.

As to the fashioning of these skin flaps, we have often enough to take what skin we can get. But when we are free to choose we should make them in such a manner that the resultant scar will not be situated in a spot where it will have to bear pressure. Thus in a weight-bearing stump it will not do to have the cicatrix over the end of the bone, nor in an amputation through the leg or the thigh will it be desirable to have the scar on the anterior surface, for it is here that the stump will come into hard contact with the artificial limb every time the patient takes a step forward.

And this is to be borne in mind, that any skin flap is able, if other circumstances be favourable, to take pressure. The fact that after a Syme's amputation or an amputation through the knee-joint or just above it, the patient can support his weight on the end of the stump, is not to be attributed to the reason that the flaps in these amputations are made of skin which is normally accustomed to bearing pressure; but to the circumstance that the flaps in each case consist of skin and superficial fascia alone, while the bone, if cut at all, is divided through cancellous tissue.

I have always marvelled at the ingenuity which led Syme to introduce the amputation which is honoured with his name, seeing that the operation is not to be

performed very rapidly, and without anæsthesia must have been a particularly painful one. Nevertheless, it is a pity that the operation has been named after the great surgeon. For its underlying principles have thereby become somewhat submerged. So much so, that I believe the average surgeon of to-day who has to amputate a foot and is faced by the alternative of "doing a Syme or taking the leg off through the middle," will choose the latter operation if for any reason he cannot obtain a satisfactory heel flap. Whereas a competent weight-bearing stump can be made no matter from *which part of the foot the skin flap is reflected. So far as* nutritional and functional purposes go, a flap from the dorsum or from either side of the foot is just as good as one taken from the heel.

One has but to compare the results of amputation at the two levels to realise how much harm has befallen through this common oversight of surgical principle.

The Division of Muscle.—With the object of reducing to the smallest amount possible the residual scar tissues, the muscles should be cut through at right angles, and so far as possible with one sweep of the knife. Apart from securing a minimum amount of scar-tissue, this transverse section of the muscles renders the surgeon's task of securing the vessels and shortening the nerves very much easier than it otherwise would be.

Cutting through the Bone.—Some surgeons before dividing the bone turn back a cuff of periosteum. This I take to be an error, because it should be our aim to obtain as smooth an end to the bone as possible, and if

portions of osteophytic periosteum are left protruding from the extremity this is likely to be characterised later on by spurs and irregularities. Therefore I think the periosteum should be cut through at the same level as the bone, and any tags which may be found projecting after the bony section has been completed, should be carefully snipped off to the level of the bone with a pair of scissors. And through the same fear of their causing an uneven surface later on, any loose chips of bone should be picked out, all bone dust being removed by lotion and swabs. In amputations through the femur the linea aspera is especially apt to be imperfectly divided with the saw, so that chips and spurs will be left behind unless care is bestowed upon these points. And when the shaft of the tibia has been sawn through, it is advisable with a second saw-cut to take off the sharp point in which the anterior ridge of the bone now terminates. And, though perhaps for rather different reasons, care should be taken to cut through the fibula at a level higher than that at which the tibia itself is divided.

Hardly necessary is it to refer to the desirability in every amputation of dividing the bone through a plane at right angles to its shaft, or in a weight-bearing stump at right angles to the line of stress.

Treatment of Vessels and Nerves.—The named arteries usually give no trouble because the surgeon knows where to find them. Beyond these there is not likely to be any inconvenience except from the muscular branches; and as each muscle has its own main artery,

these are easy enough to find. As a rule only the larger muscles possess arteries which need ligation.

Particularly important is it to find each nerve that *has been cut through, to withdraw this for an inch* or so from the surface of the stump, and to remove the portion thus withdrawn by a pair of scissors, preferably after crushing with a clamp—the object of the latter being to close the nerve sheath and so *prevent the formation* of an end bulb. In shortening the nerves in this way cutaneous trunks, such as the small sciatic and long saphenous, must not be forgotten. They are to be found by means of the vessels which accompany them.

Choice of Level for the Division of the Bone

This subject has to be considered in two divisions according to whether the patient has or has not finished growing.

A. In Adults.—Much will depend upon what sort of appliance the patient is going to wear after he has recovered from the operation, that is to say, an artificial limb or a peg leg. To perform every operation as though only one class of patient existed is a mistake in itself. A country peasant, for example, even if he could acquire artificial limbs as and when required, almost certainly would *discover for himself* that a peg leg was better suited to his purposes. And in this class of patient a weight-bearing stump is the greatest boon. For this reason I am not one of those who deride the performance of an amputation "at the seat of election." To me, it seems, there are circumstances—less conspicuous

perhaps to the surgeon of a great city than to his humbler confrère in the provinces—in which this operation is one whose deliberate choice is fully justified. And so, too, in similar circumstances it is well to amputate through the knee-joint or through the lower end of the femur, and to secure a weight-bearing stump rather than to amputate through the shaft of the femur, in order to meet the requirements necessary for an artificial limb which the patient will never wear.

Therefore, if the patient is going to wear a peg leg for the rest of his days, every effort must be made to acquire for him a weight-bearing stump, and the rules laid down by the artificial leg-makers and brought into such great prominence during the war, must be ignored.

The ordinary weight-bearing stumps are those resulting from amputations at the following levels: the lower ends of the tibia and fibula (Syme), a hand's breadth below the knee (site of election), the knee-joint, and the lower end of the femur.

On the other hand, if the patient be a professional man, a peg leg will not at all suit his purposes. And to secure a stump which can be well fitted with an artificial limb certain details have to be kept in view.

Thus, it will be of no service to amputate through the leg unless a sufficient length of tibia can be retained to activate the knee-joint of the artificial limb—that is to say, four inches. And if this length of tibia be unobtainable there is no advantage in removing the limb at a lower level than the middle of the thigh.

From the point of view of the artificial limb-maker

there are but three suitable sites for amputation of the lower limb, namely, the lower ends of the tibia and fibula (Syme), the middle third of the tibia, and lastly, the middle third of the thigh. Amputations through the knee, or through the lower end of the femur (Stokes-Gritti, Garden, etc.), are unpopular with limb-makers, because after these operations it is impossible to supply a strong and well-placed artificial knee-joint, and also to make a well-fitting bucket for the stump. So in any case in which amputation has to be performed above the level of the lower ends of the tibia and fibula, the *instrument makers prefer the bone to be divided through* the shaft either of the tibia or the femur. But whereas a bony stump of cancellous tissue can bear pressure, if the bone be divided through the shaft the patient's weight cannot be borne on the end of the stump—that is to say, unless an osteoplastic flap be made. Now, it is particularly easy and takes very little time when amputating through the shaft of the tibia to raise by means of a *broad chisel a thin osteo-periosteal flap* from the flat surface of the tibia, and subsequently to fold it over the cut ends of the two bones, suturing it into place with a couple of catgut stitches. And this gives an end-bearing stump.

The unfortunate thing is that it seems to be impossible to get a limb-maker to get out of his groove and make a suitable limb for such a stump. In my experience he invariably, and *in spite of instructions and protestations*, makes a limb which takes the pressure on the patient's ischium and leaves the nice weight-bearing

stump dangling functionless in a bucket. The osteoplastic stump is not well adapted to this treatment and usually ulcerates and gives trouble. I have had to give up this excellent operation until I can find a limb-maker whose mind has not become solidified. And until such an individual can be found I suppose osteoplastic flaps must be classed as surgical mistakes.

With regard to amputations of the foot, any portion can be removed anterior to the tarso-metatarsal joint. Hey's and kindred amputations at this level leave useful stumps, but there is no advantage to be gained in any of the amputations (Chopart, Subastragaloid, etc.) that involve division of bone between the tarso-metatarsal line and the lower ends of the tibia and fibula; in other words, if a Hey's amputation is impossible, then a Syme's is indicated.

In the upper extremity as a rule it is best to conserve as much tissue as possible. Almost the only exception is the case in which as a result of injury or disease the inferior radio-ulnar joint is ankylosed. In such a case it is better to divide the bones above this joint, in order to conserve the powers of pronation and supination. Very short forearm stumps are a nuisance, because they cannot activate the prosthetic appliance and are therefore functionless, while the knobbly end of the humerus in amputations through or just above the elbow joint is an obstacle to the proper and easy fitting of a comfortable bucket.

In connection with amputation of a finger through the first interphalangeal joint an interesting little

fallacy arises. It is sometimes advised that it is useless to amputate a finger at the proximal interphalangeal joint on the ground that flexor and extensor tendons are not attached to the proximal phalanx. Alternatively, it is advised that if amputation is performed through this joint the flexor and extensor tendons should be sutured together over the end of the bone. Both of these bits of advice are wrong. Extension of the proximal phalanx on its metacarpal bone is carried out by the slip of the extensor communis digitorum which goes to that finger. Therefore the attachment of this must be secured. But flexion of this joint is effected by the appropriate lumbrical and interossei which are themselves inserted into the proximal phalanges and the dorsal expansion of the extensor tendon. The slips from the flexor profundus and the flexor communis digitorum have no function in connection with the metacarpo-phalangeal joint, and if these tendons are sutured over the end of the phalanx, ultimate function, instead of being helped, will be hindered for reasons which it is unnecessary to recapitulate here.

B. Amputations in Children.—Some entirely new considerations arise when the subject of an intended operation is of an age at which growth has not yet ceased. We have to be most careful to bear in mind what the effects of growth will be and what the stump will be like when the patient is grown up. Almost never in the case of a child should an amputation be performed through the shaft of a bone, and if for reasons which are beyond our control such an operation has to be

done an osteoplastic flap should be made in every case. Because unless we can obtain a functional end-bearing stump, the portion of shaft which is left will become thin, atrophic, and useless.

Even the instrument makers' objections to amputation through the knee-joint largely disappear if the operation be performed on a child, because by the time he is grown up, the thigh on the side of the operation, in spite of its functional activity, will be shorter than its fellow, and so will allow plenty of room for the artificial knee-joint, while the condyles of the femur will have become so much atrophied that they will no longer cause much difficulty in the fitting of a comfortable bucket.

Primary and Secondary Amputations.—So far the question of amputation has been regarded only from the standpoint of clean surgery. There are cases in peace as well as in war where we cannot be sure that primary healing will take place. On these, if we are allowed any margin, we may perform amputation at a point more distal than will be ultimately desirable and to carry out a second operation at the proper level later on.

For example, the primary amputation might be conducted through the lower end of the shaft of the tibia, with the intention of re-amputating later on when sepsis has been subdued through the middle of the bone.

But where this is impossible we must be content to leave the flaps open and perform secondary suture later on. But the flaps must be sufficiently long in the first

place, for they will shrink a great deal In the case of a Syme's amputation—which because of its good functional results is desirable in every case in preference to a division of the bone higher up—undue shrinkage of the flap can be avoided by sawing through the os calcis and allowing the tuberosity to remain in the heel flap until the second stage of the procedure is carried out.

After treatment of Amputation Stumps —Early massage and movement of an amputation stump are essential in order to prevent fixation of the soft tissues to the cut end of the bone, and to secure freedom from ankylosis or from flexion deformity of the joint immediately above by muscular contraction These complications are far easier to prevent than to cure

Tender and Atrophic Stumps —Mention has been made already to the necessity for shortening the nerves in order to avoid tenderness of the stump, and also for preventing spurs by removing all tags of periosteum and chips of bone But apart from the formation of end bulbs, it is common to see amputation stumps which are always cold, usually tender, and frequently ulcerated And there are several factors which enter into the causation of these troublesome stumps First, there is the amount of scar tissue in the stump Suppuration of the flaps is one cause of excessive scar tissue Another is the improper formation of the flaps and the incorporation with them of muscle Providing " a good covering for the bone " usually means plastering it with pernicious scar tissue Then again, the longer the stump the more likely is it—unless it has some particular function to

perform—to suffer from chilblains and other vascular and nutritional disturbances. That is why in an ordinary amputation through the shaft of the tibia the bone should be divided through its middle rather than lower down. The shorter stump, provided that it is long enough to effect proper leverage, can activate the artificial limb just as well as the longer stump, the end of which may be regarded as a mere functionless and consequently atrophic appendage. The more active the stump, the better will its nutrition be. For this reason those stumps which bear a part or the whole of the patient's weight are more robust and satisfactory than those whose sole function is to transfer movements to the artificial limb.

When an operation is performed upon a stump for the relief of pain and tenderness due to the presence of end-bulbs, it is a mistake to cut down directly upon these with a view to dissecting them out. The proper way to achieve the end in view is to resect a segment from each affected nerve trunk at a point well above its termination. Thus, with a stump which is the result of an amputation through the middle of the arm, the proper surgical approach to the affected nerves would be through the axilla.

CHAPTER XXV

FRACTURES

A GREAT teacher of surgery was fond of addressing thus his audience of medical students: "You may think, gentlemen, that the shaft of a long bone is occupied by marrow; do not believe it. The medullary cavity is filled with base, black ingratitude which flows out when the bone is broken." With equal effect was the same moral enforced by another surgical master. "My friend," he said to me, "one day you will proceed to some country town where you will settle down in the practice of your profession. The local publican will fall downstairs and break his leg. He will send for the new doctor and you will treat him; and for the rest of his days his favourite amusement will be to show the crippled limb to every customer and to curse the doctor who failed to set it properly. When you have become older and wiser you will leave the treatment of broken bones to your rivals in the town." The lesson which these leaders wished to convey with their cynical humour is a needed one. Many a surgeon has been left with an impaired reputation, many and many a patient has been left with a damaged limb, through failure in the treatment of a broken bone.

The mistakes that are made may be discussed under the two headings of diagnosis and treatment.

Fractures which are Overlooked

We cannot expect to treat a fracture properly unless we succeed in recognising its presence, and this may be easy to overlook. Oftentimes does one meet with examples of bone injuries which have escaped detection. Although in a few of these the oversight may seem almost excusable, in most it is patently due to carelessness, while in all it is attributable to the lack of proper investigation. Perhaps the surgeon has not examined more than one part of the injured limb, or he has not compared it with its fellow; he has not used his tape measure, or he has not taken steps to secure good radiograms; above all, he has not appreciated the fact that a bone may be broken without giving rise to manifestations which are obvious upon a superficial inquiry.

In a general way there are two primary sources of error. The first is a failure to inspect thoroughly the whole of an injured limb, and the second is to be unaware of the fact that a fracture may be present in the absence of gross deformity. As a consequence of these failures, the medical attendant neither obtains the assistance of good radiograms nor adopts any suitable surgical treatment.

A child fell down and hurt his right elbow. He was seen by a doctor, who applied *lotio plumbi*, bandaged the elbow, and placed the arm in a sling. Next day, as the

child screamed whenever the arm was moved; the mother brought him to a hospital, where he was found to have a complete transverse fracture of the humerus I have seen a similar mistake made with an adult A woman, having fractured her humerus, complained of pain in the elbow alone The doctor who attended her used treatment similar to that employed in the previous case, and overlooked the fracture, in fact, he neglected *to expose the arm by removal of the sleeve of her* dress

This reference of symptoms to the joint next below the fracture is not very uncommon, it is seen with fractures of the femur as well as with those of the humerus I saw, in consultation with his medical attendant, a boy who a few days before had injured his left knee while playing football He had a copious effusion into the knee joint which was supposed to be the seat of the injury The only reason which led to the desire for a second opinion was the extreme pain from which the lad suffered On full inspection it was at once clear that the left thigh was much swollen, and, to cut a long story short, an oblique fracture of the middle third of the shaft of the femur was discovered Effusion of synovial fluid in the knee joint is not a rare phenomenon in connection with fractures of the femur, even though *the fissuring does not extend down to* the knee joint, and it is apt, as in the case just mentioned, to distract attention from the main injury

The errors mentioned above have been due mainly to neglect on the part of the surgeon to examine the whole

of the injured limb. But it is not sufficient merely to examine the injured limb; an essential step has been omitted if it is not compared with its fellow, for this may reveal a deformity which otherwise would pass unnoticed. The following is an example of an astonishing discovery arising from a comparison between a damaged limb and its fellow. A healthy, vigorous man fell down and bruised his *right* hip. When brought to hospital he was suffering from shock and was admitted. The bruised limb was examined thoroughly by the surgeon in charge, and movements of the hip-joint, though painful, were found to be normal in range in all directions, and no deformity was discovered. It was thought that fracture could be excluded from the diagnosis. Some days later another surgeon saw the patient and chanced to observe that the *left* foot was everted. This observation led to the disclosure of a fracture of the neck of the *left* femur with shortening. Curiously enough, while serving with the Army abroad, I met with a case almost identical with this one in its details.

The principle by which we should be guided when dealing with injuries is to suspect the presence of a fracture until the possibility can be excluded definitely. Even though the treatment be uninfluenced by the knowledge, it is of decided importance to know if a bone has or has not been broken, and to this end the aid of a competent radiographer should be sought in every case where there remains the shadow of a doubt. Apart altogether from the question of treatment this

course is desirable, for the patient may, of his own accord or on the advice of a friend, obtain photographs of the bones for himself; and if the radiograms falsify the medical attendant's diagnosis his credit will rightly suffer. Therefore, in the interests of both the patient and his doctor, whenever there is any doubt about the integrity of a bone it should be photographed. If circumstances do not permit of this, the disadvantage should be regarded as a misfortune and its possible consequences ought to be explained to the patient.

A word of warning may be opportune here as to X-ray examination made with the screen alone. As a means of proving the absence of a fracture the method is fallacious, and bad mistakes have occurred through placing too much reliance upon it. Every surgeon must be aware of instances in which fractures have been missed in this way. The following example may be quoted. A workman stepped on to a loose plank on some scaffolding, and to save himself from a worse fall had to jump to the ground—a height of about ten feet—and in doing so injured one of his ankles. From the nature of the injury and the appearance of the foot the existence of a bone lesion was suspected. Screen examinations were made on two separate occasions, and on both it was reported that the bones were intact. On a third occasion, however, an X-ray photograph was taken and revealed a fracture of the astragalus.

Such an example might be multiplied many times. Certainly, screen examinations are useful, especially

when they are conducted by a real expert, because the limb can be surveyed in various positions; but their limitations ought to be appreciated, and they should be supplemented always by skiagrams.

Not only by the screen examination may fractures elude observation, but they may escape detection also in a skiagram, especially if this has been taken with the injured limb in one position only. Colles's fracture of the lower end of the radius offers many instances of this; for, in the absence of lateral displacement of the fragments, this fracture may be quite invisible in a photograph which has been taken with the hand lying flat on the photographic plate.

Accordingly, and in order to avoid this fallacy, X-ray photographs of injured limbs should be taken in two different planes at least. In many cases stereoscopic skiagrams are of considerable value.

The majority of fractures which elude observation involve cancellous bone. Yet there are several kinds of breaks in the shafts of bones which are especially apt to be unperceived. These will be considered in brief detail.

Greenstick Fractures.—A common accident is for a small child to fall off a bed, or out of his perambulator, or from some other eminence on to the ground striking his shoulder. The accident is followed by much crying and whimpering on the part of the small patient. The doctor is sent for; but careful investigation on his part fails to reveal any definite indication of injury, except that the child obviously is in pain, which appears to be

increased when one of the arms is moved No lesion is found, and the child it too young to say where he is hurt Let the medical attendant beware of expressing the opinion that no harm has been done Rather let him say that the child has injured his collar bone and let him bandage the arm across the chest Probably in the course of a few days a lump will become visible over the middle third of the clavicle betraying the presence of a greenstick fracture of that bone To the little patient it may not matter at all whether the lesion be recognised or not, but to the doctor it may be of great consequence

Another greenstick fracture—at least it may be regarded as such for purposes of treatment—occurs at the neck of the femur, and this also is difficult to diagnose at first A boy has an injury, which may seem not to have been severe, to one of his hips On examining him nothing definitely suggestive of a harmful lesion is found except a moderate amount of pain on movement of the thigh Bruising is the diagnosis, and he is allowed to walk about As the days go by his limping becomes worse After some weeks have elapsed he is taken again to see the doctor, who finds to his consternation that the injured limb is one and a half inches shorter than the sound one The neck of the femur has gradually become bent beneath the weight of the body, coxa vara has developed, and the boy will have to develop a crooked spine or wear a high boot for the rest of his life

Even though an examination with the help of radio

graphy fails to demonstrate clearly the nature of the injury in the first place, the knowledge that such a sequel is possible should lead to cautious treatment of any case of injury to the hip in growing boys or girls.

Subperiosteal Fractures.—The title of these injuries explains their nature. The bone is broken, but the periosteum is not lacerated sufficiently to allow displacement of the fragments. I have seen many examples of fractures of this kind which have been overlooked, including breaks of the shaft of the humerus and femur. Quite recently I have had under my care an undetected transverse subperiosteal fracture of the radius, and another involving the olecranon. In a third case a subperiosteal fracture of the neck of the femur was overlooked by a surgeon of repute, who remarked, after examination of the patient, that it would require a very good photograph indeed to persuade him that any fracture was present. However, an X-ray photograph unmistakably revealed the lesion.

In another case, a thin, delicate-looking schoolmaster tried to jump on to a moving tram. He slipped and fell, receiving a blow upon the region of the great trochanter. Examination failed to show any bruising, shortening, deformity, or other sign of fracture. The hip had a full range of movement although much pain was complained of when it was moved. A report from the X-ray department stated that no fracture was present. At the end of ten days, the patient, who was "highly neurotic" and who was thought to be exaggerating the pain, was sent home with a spica bandage on the injured hip,

being encouraged to persevere in getting about on crutches. After a considerable lapse of time, he returned to hospital with four inches of shortening, and it was then obvious that he had been suffering from a fracture of the neck of the femur. So long as the periosteum had held together all was fairly well, but under the strain of his efforts to walk this frail support had given way, and the patient was badly crippled.

A few days ago a little girl was brought in a cab to see me. She had no splints on at the time. The history given was that she had hurt her leg in some way while playing out of doors a fortnight previously. She had been under the care of a doctor who had diagnosed nothing more than a bruise, and the child had been constantly encouraged to walk, and her wailing and lamentation when she was stimulated to make the attempt to do so were put down to naughtiness. She had some swelling of the tibia at the junction of the middle and lower thirds and a slight degree of angular deformity. An X-ray photograph revealed a complete transverse fracture of the tibia. I have seen a soldier with a similar fracture, who for some days had been looked upon as a scrimshanker and put to rough usage before a skiagram showed the genuineness of his disability.

Fracture of the patella without separation of the fragments frequently is overlooked, the case being regarded merely as one of acute synovitis.

Fractures of Parallel Bones.—When the fibula alone is fractured the absence of obvious deformity and the fact that the patient can bear his weight on the limb

are apt to lead to the breakage being missed by the doctor. And a similar error is not rare in the forearm, where a fracture of one of the two bones may fail to arouse in the medical practitioner concerned the machinery of recognition.

Another oversight is to be guarded against when both bones of the leg or forearm are broken at the same time but at different levels. Here there is a great likelihood of the unwary being entrapped, and especially so as he may be shown some perfect X-ray plates which reveal but one fracture. And the results may be anything but trivial. For a fracture of the middle of the tibia in the presence of an intact fibula often may be treated with complete satisfaction to every one concerned, merely by retaining the limb on a splint until the bone has joined. But suppose the fibula also is broken in its upper third, or, as occasionally happens, is dislocated at its upper end, the greatest care may be required in order to obtain a good result; and to achieve this end the fibular lesion must be spotted. This fallacy of recognising one fracture but failing to perceive the second, when two parallel bones are involved, is quite a frequent producer of troubles in actual practice.

As mentioned already, the majority of overlooked fractures concern the cancellous ends of the long bones and the short bones.

In the lower limb the fractures which are the most likely to escape observation involve the neck of the femur, the head of the tibia, the lower ends of the tibia

and fibula, the tarsus and metatarsus. Fractures about the ankle-joint are perpetually being regarded as "sprains," partly perhaps because the patient so often is able to walk or to limp about in spite of the injury. Both transverse and longitudinal fissures through the lower ends of the tibia and fibula, and especially through the malleoli, without much displacement, offer a never-ending series of pitfalls to those who are content with superficial examinations. The same remark is applicable to fractures of the astragalus, os calcis, and metatarsal bones. In the last mentioned breakages may come about as the result of such slight violence that the thought of a fracture may not enter the doctor's head. This was notably the case during the war with "marching" fractures. A weary soldier on the march and carrying a heavy pack would get a pain in his foot, and after struggling on for a bit would have to fall out. Sooner or later an X-ray photograph would be taken and would show perhaps a complete fracture through the neck of the third or fourth metatarsal bone. Fractures through the base of fifth metatarsal similarly may come about apart from notable violence. Unsuspected fractures of the phalanges also, though of less importance, are apt to accompany contusion of the toes.

Concerning the upper limb, I have seen two cases of fracture of the shoulder-blade—in each case the fissure was a transverse one through the lower fossa—and in neither instance was the lesion even suspected until the skiagram was examined with special care.

Impacted fractures of the upper end of the humerus, and various osseous breaks in the neighbourhood of the elbow-joint, oftentimes elude diagnosis, but not so often as similar injuries in the neighbourhood of the wrist. "Sprained wrist" is a phrase which conceals as many erroneous diagnoses as does its fellow the "sprained ankle." For a "sprain" of the wrist is likely to be a diremption of the head of the radius, or the styloid process or lower end of the ulna, if it is not a split scaphoid or fissured metatarsal bone.

Cracks of the skull, vertebral column, ribs, sternum, and pelvis are all to be found in the lists of undiagnosed ills. I have seen a patient who was able to walk about and was seemingly so fit that a complete fracture through the body of his fourth cervical vertebra remained totally unsuspected for a period of many days.

However, it would be tiresome to labour any longer over these errors. There are but few rules which it is necessary to observe for their avoidance; and these have been already discussed.

The foregoing remarks are applicable to healthy bones. It has to be remembered that a bone may give way because it is the seat of disease. And it is for us to appreciate this, to estimate the morbid valency of the underlying condition, and to adopt whatever therapeutic measures may be indicated. Often our pilot will be the radiographer, and unless we call upon him to help us we shall have no excuse, when overtaken by disaster, for crying out that we are the victims of fate.

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Treatment of Fractures

Our aims in treating a simple fracture are three: namely, to secure strong union, to *obtain good function*, and to avoid deformity. It is our business here to consider the antitheses, and to indicate the general causes of failure.

(1) *Non-union and Weak Union.*—By non-union is meant the absence of an osseous bond between the fragments of bone; while a weak union is one in which a bony junction has come about but is of so frail a character as to render the patient liable to recurrent fracture. *In a healthy individual it may be premised* that Nature is perfectly well able to heal up a fracture if the broken ends can be placed and maintained in close juxtaposition for a sufficient length of time. And the common causes of failure to acquire such recovery are separation of the fracture surfaces and inadequate stabilisation of the fragments.

Insufficient Fixation is operative mainly in connection with the shafts of the long bones and is to be regarded *rather as ancillary to the other and more potent factor*, than as a common agent itself; although, in some instances, it is undoubtedly the principal causal element. The following appears to me to be a good example. A soldier sustained a fracture of the shaft of the middle metacarpal bone of his right hand, the result of a direct blow. The injury was not recognised at the time, and in spite of his protestations of pain and incapacity to handle his rifle or carry out certain other duties,

he was retained with his unit in the front line. After a while a swelling appeared in the hand and he was sent down to the Base. The time was one of great military urgency, and he was at once transferred from the Base Hospital to a Convalescent Camp. When seen some weeks after the original accident he was found to have non-union of the fracture. During the entire interval he had received no treatment. It is not unreasonable to attribute the lack of union to the want of fixation, for the ends of a fractured metacarpal bone do not become widely separated; nor is it likely in a case such as this one that following a breakage by direct injury the soft tissues would become interposed between the fragments.

Separation of the Fracture Surfaces is responsible, alone or in combination with other causes, for the majority of examples of defective consolidation and non-union. The divorcement may be due to the interposition of soft tissues between the broken ends; to overlapping of the bones brought about by muscular contraction; to a disorientation of the fracture surfaces, as seen in breakages about the head of the humerus when the upper portion is rotated outward while the lower one is pulled inward; or to separation of the fragments through muscular traction, as happens with fractures of the patella and olecranon. But in addition to separation and insufficient fixation of the bony fragments, I am inclined to add, as an occasional cause of defective union, the use of Plaster-of-Paris splints Truly, in skilled hands good results may be obtained

by these; but it is at least suggestive that the majority of ununited fractures which I have seen and in which the absence of healing could not easily be attributed either to separation of the fracture surfaces or to want of fixation, have followed the use of Plaster-of-Paris casings. Certain I feel that delayed union is an occasional result of tightly enveloping a limb in Plaster of Paris.

There is no doubt whatever that massage of, and muscular activity in the injured member, provided that these can be procured without causing displacement or excessive relative movements of the fragments, are potent agents in favouring good substantial consolidation. And if the limb is caged up in a complete cast of Plaster of Paris these helpful agents cannot be employed.

(2) *Deformity.*—There are two causes of deformity of the bone after a fracture has healed. The one is yielding of the callus owing to a miscalculation of its power to resist stresses, and the other is bad setting. Now, bad setting is not always attributable to ignorance of mechanics. Often the neglect of anæsthesia is responsible. Owing to muscular spasm it may be quite impossible to bring about correct apposition of the fragments unless the patient is anæsthetised. And even when this factor of muscular spasm has not to be considered, the cries of the patient, the knowledge that we are causing him great pain by our manipulations, are almost sure to distract our attention and to curtail our endeavours to effect complete reduction.

I cannot help thinking that an absurd reluctance to use anæsthesia is the chief explanation of the number of unreduced Colles fractures that are to be seen in the world. For surely every medical practitioner must be aware of the necessity for disimpaction and reduction of the displacement in this fracture.

There are three kinds of deformity of bone which may be the legacies of a fracture; these are *shortening* due to overlapping of the fragments, *rotary distorsion,* and *angular deformity;* and these may be combined. It is desirable, of course, to avoid the shortening of a limb, especially in the case of the lower extremity; nevertheless, this defect is not so harmful to function provided that it is not accompanied by rotation or incorrect alignment of the limb. On the other hand, the deviation of a lower limb from its normal axis is a disastrous affair. The crooked leg is crippled. For the centre of gravity, when the patient tries to throw his weight on the limb, no longer coincides with the bony supports. I suppose that more discredit has fallen upon the profession of surgery through such failure to secure good alignment after a leg has been broken than from any other single cause.

(3) *Impaired Function through Contractures and Stiff Joints.*—It may seem a commonplace to say that a good functional recovery may still be wanting even though strong union without deformity has been secured. Nevertheless, commonplace contains the truths that are essential. And there are good reasons for mentioning the subject here, seeing that its significance is so often

ignored. Not seldom is a stiff joint or a contracted muscle the penalty paid for a straight bone.

A fractured leg has been fixed for several weeks in Plaster of Paris, with the foot slightly in a position of equinus; and when the splint is eventually removed it is found that, although perhaps the bone has healed satisfactorily, yet the patient is unable to walk normally because his gastrocnemius has undergone contracture and he is consequently unable to get his heel to the ground.

The formation of adhesions in and around an articulation is sometimes difficult to avoid, for example, in a Pott's fracture. In this injury the ankle-joint is directly involved, and early massage and movement are therefore desirable. Nevertheless, in the early stages there may be a persistent tendency for the deformity typical of this lesion to recur whenever the retentive apparatus is removed. Consequently, it is necessary to hedge, and to defer our manipulations until sufficient consolidation has taken place to allow us to release the limb periodically from the splints without danger of reproducing the former displacement.

Again, with fractures of the femur, it is not easy always to avoid some stiffness of the knee-joint unless we treat the fracture either by plating it or by means of calliper extension, both of which plans have their own perils. By using the ordinary methods that are in vogue we cannot exercise the knee-joint except by releasing it from the splint. But we can rock the patella from side to side and perform some massage of

the quadriceps muscle from the first, and at the end of three weeks at the latest we can attempt a little movement of the knee-joint.

Making every allowance for these special cases, there is still a large residue in which there is no contra-indication whatever to carrying out at an early stage gentle movements of the joints of a broken limb. Many fractures, and especially those which are confined to the cancellous ends of the long bones, show but little tendency to recurring displacement; indeed, many of them, for example, a Colles fracture of the lower end of the radius, provided reasonable care be exercised, do not need even a splint to retain the fragments in a proper position once their complete replacement has been effected. In these cases there is no real difficulty whatever.

But a few words of caution must be uttered. When one talks about early movements one does not mean vigorous and unrestrained movements, still less does one mean perpetual motion. A moment's meditation will *show that one single passive manipulation through* a wide range of movement every fourth day or thereabout will absolutely prevent a joint from becoming stiff with adhesions, for these do not form in a night. The warning is necessary, because when a fracture involves a joint, that joint requires rest as long as it feels hot to the touch. If unrestrained movements are allowed before the joint is sufficiently recovered, osteo-arthritis is likely to be a sequel, and it may be a lasting one.

Use of Callipers and "Ice Tongs."—I have referred to the application of extension to a fractured femur by means of callipers which transfix the skin and take a direct grip on the bone. This is a method that certainly has its uses. Nevertheless, it is not without a certain danger. For the synovial membrane of the knee is an extensive one, and overlaps a large and variable portion of the lower end of the femur. The points of the callipers consequently are apt to pierce this membrane and carry infection into it from the skin. I have seen two cases of suppurative arthritis of the knee-joint set up in this way. It is true that both the patients were wounded men. But since the anatomy of a soldier is not markedly different from that of a civilian, the mishap is clearly to be apprehended in civil life also if callipers be used.

Plating and Wiring Fractures.—Provided that the operator is a good mechanic, the surest method of acquiring union of a broken bone without any deformity at all is to expose the injured structures by an open operation, and to fix the fragments together in their correct position by metal plates or bands or some other rigid material. In addition to the accuracy of adjustment attainable by these means there are other advantages, including the use of less rigid splinting, the facility for early massage and movements, and the avoidance of splint sores. Nevertheless, the method is not to be encouraged yet as one that is suitable for general adoption. For it should be carried out only in circumstances that are favourable to the strictest asepsis, and by a

surgical team that is well drilled and practised in this difficult technique. For sepsis is a real danger in the large wounds that are required for the operation.

There is another and less grave disadvantage, in the persistent pain from which patients sometimes suffer after the successful plating of a fracture. Owing to these limitations the plating of fractures, even in the hands of the most skilful surgeons, will be reserved only for those cases in which a good functional result is not to be anticipated from the less drastic and more old-fashioned methods of treatment by splints. And the decision of this point cannot be left to the arbitrament of time; for it is a fallacy to suppose that splinting may be tried first with the idea that an open operation can be done subsequently if the results of the splinting prove unsatisfactory. To achieve the best results, a plating must be performed early, that is to say, before the processes of callus formation and repair have made headway.

Fractures of the Patella.—A few words may be said about fractures of the patella in order to mention some specific errors that are not uncommon in connection therewith, as well as to introduce one or two remarks on wiring in general.

I have heard a surgeon of repute state that all transverse fractures of the patella should be treated by wiring the fragments together. With such a statement I am in absolute disagreement. The reason why the fragments of a broken knee-cap so often fail to unite when treated by other means than fixing them together

by sutures, as has been stated on a previous page, is their separation caused by the pull of the quadriceps extensor upon the upper fragment. Now, this separation can be sufficient to interfere with subsequent function—which consideration should be our sole guide in the matter—only if the strong aponeuroses on each side of the patella are also torn; which is not always the case. Still less can it be necessary to wire the patella when the bone is merely cracked across without even its periosteum being ruptured; and such cases are to be met with. The fact of the matter is that the lacerations of the lateral aponeurotic expansions are the real lesions which call for a remedy that cannot be supplied otherwise than by exposing them and sewing up the rents. If the separation of the patellar fragments is greater than a quarter of an inch, we may judge that these structures have been torn, and will require suturing. If the separation is less, we may assume that perfect function may be regained without an operation.

It follows from these remarks that "wiring the patella" is not quite a correct description of the procedure, for it emphasises a less essential part of the operation. Moreover, wire is not necessarily the best material to use even for uniting the pieces of bone. However, the name is accepted and convenient, and so long as it is realised that suture of the aponeurotic expansions is the essential step, no great harm will be done.

The incision, as logically follows the foregoing remarks, must be curvilinear, so that a flap may be

turned up in order to gain a proper exposure of the whole field. A patient came to me on account of a sinus over his patella, which had previously been wired. The incision had been a median vertical one, and the ends of the wire were placed immediately beneath the scar, and had given rise to the sinus. Clearly the incision had been inadequate and the wire badly placed; for if wire be used it should be inserted at the edges of the bone, where it will not be subjected to repeated pressures transmitted through the skin.

Some doubt may be cast on the necessity for using wire at all. Silver wire is not strong and may easily be broken while twisting the ends, or later on when commencing movements. And unless both ends are twisted—which is not always done—the straight end may slip out of the coiled one and the fixation is no longer complete. In addition to these disadvantages the wire itself is apt, when it is being tightened up, to cut through cancellous bone, unless a good bite has been taken. On the whole, therefore, it may be regarded as better to use some softer material for suturing the bone, such as silk or strong catgut, and if wire of any sort be used, twisted brass or copper wire, as used for hanging pictures, is much to be preferred to silver wire.

Wiring of Other Bones.—I have seen some queer results which have followed attempts to fix broken fragments of bone in place with wires. For the most part these have been examples of angular deformity, and have been the consequence of inserting the wires nto one surface only of the fractured bone, which is

quite insufficient to maintain the fragments in the corr
axis. The fault is often attributable to the use
straight incisions, which give too small an exposure
the parts.

Stiff Joints following Fractures.—Reference has be
made upon a former page to joint stiffness followi
fractures. But a little amplification of the subject
necessary in order to call attention to a certain cat
trophe that may come about as a sequel. As a gene
rule, the limitation of movement can be overcome
a course of massage and exercises. But it sometim
happens that the masseur cannot get even a trace
movement to work upon, and in this state of affai
it may be thought necessary to move the joint forcib
under an anæsthetic in order to make a start; for on
we obtain some movement it usually can be increased b
subsequent repeated manipulations and massage withou
anæsthesia. The point to remember is that the bon
in these cases of complete fixation, owing to the prolonge
loss of function, are atrophic and very easily broke
Many times have such fractures occurred during attempt
at forcible movement under anæsthesia. The patell
in particular suffers danger when injudicious attempt
are made to restore movement to a rigid knee. Th
precautions to be observed are two in number. Th
first is to avoid wrenching under anæsthesia until othe
methods have proved unavailing. Such methods wil
include, in the case of the knee-joint, for example
resting the limb upon a sand-bag placed just above the
knee, so that the whole weight of the leg is constantly

exerting a pressure in the direction of flexion. The other precaution is to use restraint when trying to obtain movement under anæsthesia, and to be content with small achievements, instead of endeavouring to move the joint through its full range. If we obtain any movement at all our object will have been gained, and further improvement probably will follow the work of the masseur. Moreover, even limited activity in the articulation will bring about an improvement in the strength of the bones, and they will be less likely to give way if subsequent forcible manipulation under anæsthesia are considered desirable.

Splint Sores, caused by the constant pressure of a splint, are fruitful sources of trouble. I have seen a chronic indolent ulcer of the heel brought about in this way, which took longer to heal than did the broken bone. The avoidance of this complication is a matter of general intelligence, and no further reference to the subject is necessary.

Volkmann's Paralysis.—Though originally observed in connection with fractures, especially those about the elbow-joint, it is now known that the muscular distrophy which is the chief element of the paralysis is due to obstruction of the arterial supply of the limb by the pressure of the splints combined with tight bandaging. Now that its cause is so well known, the complication is but rarely seen.

surgeons. *Flat-foot* is a good example. A child some prolonged illness during which he is kept in b His calf muscles become weak and atonic, and when begins to convalesce and to get about again, they no longer able to support the arch of the foot agai the weight of the body, and he becomes flat-fool This fact passes unnoticed, and the child has to ad a peculiar and clumsy gait; he cannot run with speed, because with each step he has to bring his hee the ground. At last advice is sought, and the condit of talipes planus is discovered, but at so late a d that a *restitutio ad integrum* is a practical impossibili the child has adopted the flat-footed posture as a ha and even though what might be regarded as a cure the causal muscular weakness can be obtained. false and clumsy gait, together with the consequ defect of athletic ability, is likely to remain. frequency with which a condition of talipes pla develops in this way without attracting the doct notice is remarkable.

Although, of course, in a typical instance the a of the foot gives way owing to lack of power in the muscles to give it sufficient support, this lack of sup is not necessarily attributable to any patholog weakness. It may be that average muscles are ca upon to perform excessive duties, and so give beneath the strain. This is what happens in a c of fractured tibia and fibula in which the bones h united with angular deformity and eversion of the f

mechanical relationships may be beyond the power of the strongest muscles.

Scoliosis is another example of deformity consequent on muscular weakness. Knowing this to be the cause, it is the aim of treatment in a typical case to restore muscular power, while arresting the progress of deformity and perhaps bringing some amelioration to the patient of that degree of crookedness which already has taken place. Prevention is the key to success, and the underlying muscular weakness should be detected even before any deformities have become established. The myasthenic condition is no more difficult to detect than adenoids or tuberculosis of the hip-joint. Scoliosis and talipes planus are examples of deformity due directly to the fact that certain muscles are not sufficiently strong to support the direct load that is placed upon them by the force of gravity. But there is a still larger group in which the cause of deformity is not the force of gravity, but is the predominance of one group of muscles over an opposing group. Such a *defective muscle balance* is the cause of congenital equino-varus, as well as the various deformities which are seen as sequels to anterior poliomyelitis.

Congenital Club-foot.—In this condition there is a relative impotency of the peroneal muscles, and especially of the *peroneus tertius*, which are unable to sustain a proper counteraction to the tonic pull of the other calf-muscles. For this reason the foot assumes a position of equino-varus. In this position the peronei are lengthened and kept continually so, and therefore

become progressively weaker, because muscles that are perpetually kept on the stretch by the overpowering tonus of an opposing group become less and less able to fulfil their proper functions as time goes on. And not only do they become stretched, but the opposing muscles undergo adaptive shortening, so that if the condition is left to nature it will in time be impossible to restore the foot to a natural position even by manipulation. At a later date still the bones and ligaments of the ankle and tarsal joints will have undergone considerable modification in shape, thus offering still further obstacles to the assumption of a correct posture.

Clearly the treatment consists in recognising from the very first the underlying weakness of the peroneal muscles and restoring a proper muscular balance. This is to be done by reversing the process through which the deformity has come about—that is to say, by fixing the foot in such a position that the healthy muscles are kept on the stretch, while the affected ones are in the reverse condition. True it is that a baby's foot is not so very easy to fix in the required position; nevertheless, the aim can be achieved by energy, devotion, and experience.

The remedial effect of proper bandaging and fixation on these cases of congenital club-foot was familiar to Hippocrates, and one cannot help but believe that the neglect of the deformity while in its early stages that is displayed by modern medical men has arisen through despair of obtaining proper treatment. A good deal of practice and perseverance are required for this, and

excusable to reiterate that in all these cases of defective muscle balance established deformity may be avoided by bringing continuous aid to the muscles which are weak. Further, that the necessity for tenotomy or tarsectomy is usually a disgrace to surgery. These operations are not final procedures, they do not cure the defective muscle balance; they merely serve to undo in rather an unsatisfactory manner some proportion of the effects of past neglect, while the necessity for continued treatment remains.

With regard to tenotomy of the tendons activating the foot, I have no record of any disasters, but I have been informed of an instance in which the femoral artery was injured during a subcutaneous tenotomy of the adductor tendon. Doubtless the external popliteal nerve has been damaged in operations on the biceps tendon. The operation of subcutaneous tenotomy was introduced originally in the days of John Hunter or thereabout, because it offered a means of severing tendons without the necessity of having to face subsequent sepsis. This reason no longer carries weight. And although the subcutaneous operation has certain convenient advantages, these are not sufficiently great to warrant the risks that must be run in attempts to apply the operation to tendons which are in close and dangerous proximity to other anatomical structures whose injury would be disastrous.

Osteotomy has its own drawbacks. I have one particularly poignant memory in which I performed a supracondylar osteotomy for knock-knee. On account

of a long illness I was prevented from carrying out the after-treatment, and during my absence, the leg having been "put up" in Plaster of Paris, the patient had been sent out of hospital. When I next saw him the bone had united, and the deformity remained just as pronounced as it had been before the operation.

Personally I regard Plaster of Paris, unless applied by an expert, as a dangerous means of fixing bones which have been broken or divided by the surgeon. Not only may unwanted and unexpected deformities be revealed when the plaster casing is removed, but the bones may have failed to unite.

The actual performance of a simple osteotomy is not a difficult procedure, but there are certain mistakes which may be made during its performance. A minor one is the unintentional division of the bone in an oblique direction; that is to say, in a plane which is not at right angles to the long axis of the bone. Another is to use the osteotome as a lever in order to complete the fracture of a partially divided bone. I was a spectator while a surgeon was performing a supracondylar osteotomy for genu valgum. Having driven his osteotome well into the femur, he endeavoured by a levering movement to complete the severation of the bone. Unluckily it was the blade of the osteotome which broke. The greatest difficulty was met with in the endeavour to extract the broken fragment of the tool, which was still firmly buried in the bone when I was obliged to quit the scene.

There is always the possibility of damaging important

soft tissues either with the edge of a broad osteotome while dividing the bone, or by driving the osteotome through the limb with the last blow of the mallet. I have heard tales at second hand of such occurrences, but do not know of an authenthic instance; but the danger appears to be a real one.

The Malposition of Joints which is so often seen to follow Arthritis is another slur upon modern surgery. Recently I had under my care a girl who had suffered from subacute arthritis in both hips. She had recovered. But the hip-joints were ankylosed, with the thighs in a position of acute flexion, the left one being abducted while the right was adducted. The adduction of the right thigh had led to severe genu valgum, while the left knee was in a position of varus. Subtrochanteric osteotomy had to be performed on both femurs, and later on a supracondylar division of the right femur was necessary to remedy the genu valgum, before the patient was able to stand and shuffle about on her own legs. With proper precautions these deformities would not have come about, and the subsequent operations would have been unnecessary. The case is a good illustration of a common medical failing, namely, the omission to keep an inflamed joint in such a posture that if ankylosis occurs the accruing evil will be as small as possible.

In the softening of bones from disease, as, for example, caries of the spine and curvature of the tibia from rickets, the keynotes of treatment are the cure of the disease and the prevention of deformity. I have nothing specific to say about these conditions which are

responsible for so much crippling, and mention them merely because they add a volume to the slogan of orthopædic surgery, which is "prevention, prevention, prevention."

Tendon Transplantation

On more than one occasion the operation of tendon transplantation has been suggested to me as a remedial measure in certain cases of deformity. It is therefore excusable to make a point of the matter and assert the general proposition that if any transplantation of tendons is contemplated, complete reduction of the deformity with over-correction must be accomplished first.

Bone Grafting

The desirability of avoiding sepsis of course needs no amplification. But there are certain points that can be usefully considered. One of these is the necessity for fixing the graft and the limb so that the former shall not shift about in the slightest degree in its bed.

When a bone graft is being cut in the usual way from the tibia and, the parallel longitudinal cuts having been made, the ends of the graft are being divided, it may happen, unless precaution is used, that the graft will spring out and land upon the floor. I am told that the right thing to do in such an event is to have the graft washed and then boiled for five minutes, after which treatment it may be used. On one occasion I had prepared a long tibial graft, and having folded it in gauze, I had placed it in a bowl whilst putting some

finishing touches to the ends of the bone to which it was to be affixed. While I was thus engaged a probationer removed the bowl from the theatre and emptied its contents into the bin which received soiled swabs and other refuse of operations. Although the graft was retrieved I had not the courage to make use of it.

Perhaps it is worth while mentioning the risk that follows the removal of the tibial crest in order to obtain a bone graft; for there may be occasions when the temptation arises to adopt this easy method. The drawback is that the strength of the bone is so much diminished by removal of the crest, that the patient may subsequently suffer from a tibial fracture brought about by relatively slight violence.

CHAPTER XXVII

ARTHRITIS

The knee-joint, being the largest and most commonly affected articulation, will be taken as the example in the remarks which follow; these are for the most part applicable more or less directly to any joint in the body.

We have to consider the subject under three headings, viz. (1) Aseptic traumatic synovitis, (2) Atraumatic synovitis without infection, (3) Infective arthritis.

I. ASEPTIC TRAUMATIC SYNOVITIS OF THE KNEE

A. Diagnosis

At the first there may appear to be but little scope for discussion with regard to the diagnosis of traumatic synovitis. The subject appears so simple. Yet this apparent simplicity is continually producing a rich crop of errors. As a matter of fact, much care and deliberation are required, for there are numerous pitfalls for the rash and unwary diagnostician. Thus, to take an actual example, a patient sought medical advice because he had a swollen and painful knee, and he

attributed the condition to an injury received a week previously in getting out of a dogcart. He had obvious synovitis; he had had an injury; therefore, argued the incautious one, he had traumatic synovitis. So the patient was advised and treated accordingly. A week later he complained of pain and swelling in one of the testicles, and it became clear that he had gonorrhœal epididymitis, and this was followed by the revelation that trauma, if it had played any part at all in the inflammation of his knee, had been quite subsidiary to gonorrhœal infection. Examination of the urine in such a case would have revealed the white shreds of gonorrhœa, and so have led to a correct interpretation of the joint affection. Moreover, the history of the injury proved to be quite indefinite. The patient did not fall to the ground, nor did he pay much attention to the supposed accident at the time.

The writer himself has seen osteo-arthritis, tuberculosis, syphilis, gonorrhœa, and rheumatism of the knee, each buried away—for a time—beneath a diagnosis of traumatic synovitis.

As to the lesion which is present in any particular case of traumatic arthritis, it is not always possible to do more than make a good guess. There may be laceration of a semilunar cartilage, expecially the inner one, or a synovial fringe may have been pinched between the femur and tibia, or some other damage may have been done. However, apart from this doubt about the actual lesion, the cases form a group sufficiently homogeneous for collective consideration.

Examination of the Patient

The clinical investigation must be systematic and thorough. Mere examination of the injured joint is not sufficient; a complete survey of the case is essential. As to the history, there ought to be a perfectly clear and definite account of a sudden, painful, and sufficiently severe injury to a knee in which nothing abnormal had been felt up to the moment of the accident, the injury being followed within a few hours by swelling of the joint. If the history of trauma is indistinct, if the patient thinks he hurt his knee but is not quite certain about it, or if the swelling of the joint did not appear until a week or so after the supposed cause, suspicion should arise that the accident has merely elicited evidence of disease hitherto unsuspected in the joint. Locking of the knee—that is to say, inability to extend the leg immediately after the accident—is good evidence that a semilunar cartilage has been damaged. The patient's account of the local affection having been elicited, he should be asked if he has had previous trouble with his knee, if other joints are or have been affected, and also if he is in good health and free from any constitutional trouble. If his replies are satisfactory and confirmed by the usual general examination, attention may be directed to the injured part. For this purpose both lower limbs should be made bare, so that fair comparisons can be made. On looking at the affected joint one expects to find it in a position of slight flexion and distended with fluid. Palpation reveals a moderate

increase of surface temperature, as compared with the sound side, and there is some tenderness; but there should be little if any wasting of the muscles of the injured side. In the absence of an obvious superficial hæmatoma, pitting on pressure is suggestive of either fracture or infection; and if the skin be dusky or reddened one may suspect that something more than simple traumatic synovitis is present.

On handling the joint in such a manner as to obtain fluctuation, the capsule of the joint is felt to be normally thin and flexible, so that the sensation of fluctuation is easily obtained and the fluid seems close beneath the fingers. Whereas *in some infective conditions*, especially in gonorrhœal and pneumococcal arthritis, there is sometimes much peri-articular effusion, which renders the capsule hard and stiff, and so obscures the fluctuation of fluid within. With syphilitic and tuberculous synovitis the synovial membrane may be swollen and "pulpy," and this, too, obscures fluctuation.

When the knee-joint is distended with fluid the *patella is pushed away from the femur, with which normally it is in contact.* If the effusion be of the kind which is poured out in response to trauma, the patella ought to be freely movable from side to side, and, when pressed backwards, the contact between the patella and femur should be felt as a clear, unmuffled tap. In the presence of peri-articular effusion the patella cannot be so freely moved from side to side, and if there be pulpy swelling of the synovial membrane, the tap of the

patella against the femur will be muffled. In advance cases of infection the patella may be fixed to the fem by organising granulation tissue, but such advance instances of infective arthritis are hardly liable to l confused with traumatic cases.

Though tedious and difficult to describe, the manipulative examinations of the joint are quickl and easily performed, and are capable of conveyir important information.

There is one more point. Pressure over the intern semilunar cartilage is usually painful, and this has bee supposed to indicate injury to the cartilage. It h no such meaning, for tenderness at this point is preser in most cases of arthritis of the knee.

Only to the dull or inexperienced will all the abo suspicions and precautions appear excessive. A fe days ago the writer saw a case which had at first bee diagnosed as traumatic synovitis of the knee turn ou to be an acute suppurative arthritis; and in anothe recent case a knee-joint was operated on for the remov of a damaged semilunar cartilage, whereas tuberculou arthritis was discovered. In the latter case there wa no doubt whatever about the history of sudden sever trauma; and in the former also, though the histor was not so definite, the trouble was believed to hav originated in a sprain. These and numerous other case demonstrate that without the utmost care and per severing caution mistakes in diagnosis can hardly b avoided.

In every case X-ray photographs should be obtained

preferably of both knees, and taken in lateral and antero-posterior directions.

Certain Errors of Diagnosis

When a patient, who has a displaced cartilage in the knee, has been kept at rest for a time, the synovial effusion may entirely disappear, though locking of the joint and an increased surface temperature are still present. I have seen a few such cases, and on the first occasion the absence of synovial effusion led me to question the correctness of the diagnosis of displaced cartilage. I mention this lest others might be inclined to make the same mistake.

Fractures are sometimes the sources of error. I have seen more than one instance in which a fracture of the patella has been overlooked in a case under treatment for traumatic synovitis. The oversight is most likely to happen, of course, when there is no separation of the fragments, the periosteum and aponeurotic expansions remaining untorn. Even without the use of radiograms this lesion can usually be correctly diagnosed by the acute sensitiveness of the patella, aided in some instances by the fact that some lateral movement can be elicited between the fragments. Other signs which may lead to a suspicion of fracture are pitting on pressure over the patella and the presence of an actual hæmatoma or discoloration of the skin due to the diffusion of blood in the subcuticular structures.

Perhaps less widely appreciated as a cause of effusion into the knee-joint is fracture of the shaft of the femur.

Here again it is especially in connection with subperiosteal fractures, in which there is little or no actual displacement of the fragments, that mistakes may arise. For example, a schoolboy, while playing at football, crossed legs with an opponent and fell to the ground. He was seen by his doctor and treated for traumatic synovitis of the knee. A few days later I was called into consultation owing to the excessive pain from which the boy suffered on the slightest movement of the injured limb. The knee-joint was distended with fluid, but a careful examination brought out the fact that the excessive pain was not elicited by movements of the knee itself, but was caused at once by any movement of the thigh. An X-ray photograph revealed an oblique, subperiosteal fracture of the femur, at the junction of the middle and lower thirds, unaccompanied by any material displacement of the fragments.

It should be known that fractures of the shaft of the femur are frequently accompanied by effusion into the knee-joint, and that this effusion does not of necessity indicate that the fracture has extended into the joint or that the knee has received any independent injury.

Exact diagnosis will, of course, demand something more than a mere appreciation of the fact that a synovitis of the knee in any particular case is the consequence of an injury, for the precise nature of the lesion and the condition of the knee before the injury should be ascertained if possible. But it will occupy too much space to discuss here the differential diagnosis of these

lesions, or the part played by pre-existing abnormalities such as osteo-arthritis.

B. Treatment

There are two fundamental principles in the treatment of traumatic synovitis of the knee. The first is to overcome any "locking" that may be present, and the second is to procure rest for the injured joint.

Reduction of Locking

By locking of the knee is meant inability to extend the leg completely on account of the interposition of a displaced fragment of cartilage or a loose body between the ends of the femur and tibia, or between the ends of the bone and the capsule of the joint. Until reduction has been brought about, either by chance or by definite procedure, recovery is not to be expected. Locking may be thought to exist when it is absent. If an effusion into the synovial cavity be very copious, so that the joint capsule is tense and hard, the patient will naturally have his knee flexed, because the capacity of the joint is greatest with this posture; and in such a case complete extension of the leg may be impossible. But this limitation often can be distinguished from true locking by palpation of the knee while the effort to extend the leg is being made. The sudden check due to true locking is in this way differentiated from the gradual limitation due to distension of an inflamed capsule. Moreover, the patient will be able to judge from his own sensations whether the limitation of extension is or is not due to the interposition of something in the joint. An accurate

history of the injury also will aid in the diagnosis, for, if true locking be present, the patient will have been unable to straighten the limb immediately after the injury was received and before the swelling of the knee appeared.

Reduction is performed most satisfactorily with the patient anæsthetised, both because the process is apt otherwise to be painful and because it is easier to make sure that the reduction is complete.

The manipulation required is to flex the leg on the thigh to the fullest degree possible, to pull upon the tibia so as to separate the articular surfaces, to rotate the leg outwards and inwards, and then to extend. If reduction be not effected at the first attempt the manœuvre should be repeated with varying amounts of flexion and rotation.

Curiously enough, it is a frequent error to overlook the presence of locking. Quite recently I have had two cases under my care in which locking had been present for six weeks and three months respectively. I think in these two cases locking was unsuspected, at any rate no serious effort had been made to bring about reduction. The result of such neglect is that it soon becomes impossible by external manipulation to unlock the knee, and operation therefore becomes imperative if normal function is to be restored.

How to secure Rest

The proper treatment of an injured knee, like that of any other joint, usually involves complete rest, continued

the fact that the patient is a bleeder. However, I have been temporarily led into error in this disease, and so I suppose have others.

Syphilis, too, may be mistaken for tuberculosis. Some years ago, before the diagnosis and treatment of syphilis had reached their present refinements, a boy was attending among my out-patients with numerous lesions of bone with sinuses one of which led down to the great trochanter of his femur. I had regarded the case as tuberculous, and had been carrying out treatment in this belief for some time without much success. One day when he was lying in one of the side rooms waiting to be examined, the nurse said, "That boy with congenital syphilis is ready for you." I pricked up my ears at this, and asked what made her diagnose the condition as due to congenital syphilis. "Oh," she said, "the mother told me that her husband had given her the disease before the boy was born." Once or twice I had removed sequestra from sinuses in this boy, and sequestra, as every one knows, are not common in tuberculosis; I had attributed them to secondary infection. Antisyphilitic treatment was employed at once and produced an immediate and astonishing improvement; and there could be little doubt that congenital syphilis, if not the only factor to be reckoned with, was a most important one. On further inquiry it was found that a brother and sister of the patient at the same time had multiple sinuses with occasional sequestra. They both had sinuses in the left elbow, in addition to many other lesions; the boy had under-

gone excision of the elbow-joint, the operation having been followed by a persistent sinus; the girl had not been submitted to this operation. Under specific treatment they both got well forthwith. In these cases there could be no doubt about the correct diagnosis, for they had been ill for years without getting better until they took mercury and potassium iodide, and then they immediately proceeded to recover.

A special feature of syphilitic joints in children is their relative painlessness. Sometimes this is so striking that it points to the correct diagnosis almost with certainty. Moreover, the condition is not seldom bilateral, both knee-joints being simultaneously affected. As a consequence of the freedom from pain, muscular rigidity is not nearly such an early or common occurrence in the affected limb as it is in cases of tuberculous arthritis. Other stigmata of syphilis, especially the characteristic dental defects and interstitial heratitis, may give useful information if looked for, while a Wassermann test may be of value, though it is not to be regarded as an absolute criterion.

P. W. Roberts,[1] referring to a large series of cases of syphilis affecting the bones and joints, and discussing the differential diagnosis between this condition and tuberculosis, states that little help was given either by radiography or by the Wassermann reaction. The radiograms, he states, "showed no characteristic points of differentiation, and the Wassermann reaction was frequently negative in the face of other evidence of

[1] *Amer. Jour. Syph.*, 1920, p. 309.

syphilis and response to antisyphilitic treatment especially in late inherited syphilis." And this rather tallies with my own experience so far as concerns osteitis resulting from congenital syphilis.

Chronic staphylococcal abscess in one of the articulating bones and *sarcoma* are less common sources of confusion in diagnosis; and it is hardly necessary to add that mistakes are less likely to arise if a routine practice be made of obtaining good radiograms in every instance in which a joint is under suspicion of tuberculosis.

Section VI. MISCELLANEOUS

CHAPTER XXVIII

VARICOCELE, HYDROCELE, AND SWELLINGS OF THE TESTICLE

Varicocele

As in the case of most surgical operations which are easy to perform, that for the treatment of varicocele provides a host of errors and catastrophes. So true is this that the prudent surgeon will not be very ready to advise his clients to have the operation done.

Sloughing of the testicle and death from septicæmia I have heard of more than once, but have not seen. But I suppose that most of us have seen instances in which the result of the surgeon's handiwork has not been perfectly satisfactory.

Sepsis invading the venous channels of the pampiniform plexus is particularly dire in its effects. I have seen a case of pyæmia follow an operation for the cure of varicocele, though the patient ultimately and after a prolonged struggle escaped with his life.

Atrophy of the testicle is an occasional sequel. Of course with bulky varicoceles the testicle often is small and soft; but I have seen a young man who, according to his own account, had not suffered from a

bulky hydrocele, present himself after operation with atrophy of the testicle. One cannot help suspecting that this result is due to injury of the vas or its artery or both. However this may be, the sequel is not so very rare. I have seen sterility in a married man due to atrophy of both testicles after a double varicocele operation, and I have seen also a patient with atrophy of one testicle and hydrocele of the other following a similar procedure.

Why it had been thought necessary to operate on both sides in these two cases I know not. Such necessity must be rare.

Hydrocele is quite frequent as a sequel to operations for the relief of varicocele. There is a quaint atmosphere about the following case.

A young man once asked me to operate on him for varicocele. The condition was not very pronounced and did not in any way hinder him from earning his livelihood, which was that of a clerk. In view of these facts I advised him not to undergo any operation. "Well," he said, "the fact is I am going to get married, and my future mother-in-law insists on my having the operation done first." So I did the operation. Not long afterwards the poor fellow returned to me with a hydrocele, and this too had to be cured before he was allowed to marry.

As to the reason why a hydrocele sometimes follows ligation of the spermatic plexus of veins I feel uncertain. It may be due to the ligation of too many veins; but this does not readily fall into line with the fact that

hydrocele is a fairly frequent after-result of operations for the relief of inguinal hernia.

Personally I have not been in the habit, when operating for varicocele, of removing a portion of the tunica vaginalis testis in order to forestall the complication of hydrocele. But it is done by some surgeons and is perhaps a good practice.

One startling disaster in an operation for varicocele occurred as follows: the surgeon made the usual incision, hooked his forefinger around what he took to be the spermatic cord, drew it up into the wound, applied two ligatures and divided the tissues between. He then allowed the two ends to slip back into place, and sutured the wound. Later on he was summoned to the patient who could not pass his water and consequently was in great pain. Catheters were of no avail. None could be made to enter the bladder. And, to cut the story short and to omit most of the harrowing details, it was found that instead of ligating the spermatic veins the surgeon had ligated and severed the penis.

The above is almost too gross an error to put into print, but as it happened once I suppose it might happen again. Of greater interest because of greater frequency are the less startling drawbacks of the operation.

Persistence of the varicocele is one of these and is the result of an error on the right side; that is to say, in his anxiety to avoid doing too much the surgeon has done too little.

Another trouble is the persistence of a painful scar. To avoid this there are several precautions to be taken.

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Another trouble is the persistence of a painful scar. To avoid this there are several precautions to be taken.

Firstly, the spermatic fascia should be opened, the ligatures applied within it and not through it, the fascia then being closed again. Secondly, fine catgut is quite sufficiently strong to occlude the veins and should be used for this purpose. Lastly, the deep layer of the superficial fascia, which is a distinct and easily recognisable structure in this region, should be closed by a continuous layer of fine catgut.

A common practice when performing the operation is to resect a segment of the pampiniform plexus and to join together the ends. Whether necessary or not, the idea of this manœuvre is, I believe, to sling up the testicle and so to prevent it from sagging down in the bottom of a lax scrotum. However, the resection may be overdone, and in such a case I have seen the testis tightly anchored in front of the os pubis just outside the external abdominal ring, and causing the patient much discomfort.

Doubtless a large proportion of the unsatisfactory results which have followed surgical interference for the relief of varicocele is due to the fact that the operation is commonly regarded as one which any inexperienced surgeon can do. But the operation itself, however well performed, is not a perfect remedy, and the surgeon should weigh carefully the pros and cons before he advises his client to submit to its performance.

Before turning to another subject, it will be right to mention that varicocele in some instances is an important symptom indicating trouble elsewhere. David Wallace [1]

[1] *Lancet*, July 1906, p. 91.

records an instance of renal tumour in a man of fifty where it was a rapidly developing varicocele which drove the patient to the surgeon. And Sinclair White [1] has had a similar experience in connection with pyo-nephrosis due to renal calculus. Indeed, the occasional dependence of varicocele upon a renal disorder has been a favourite quip with clinical teachers for many years. I suspect unwary surgeons have been caught in the trap before now, and will be again, though I have not actually come across an example.

Hydrocele

There are two maxims that must preface my remarks on the subject of hydrocele.

The first is that in all swellings of the testicle or tunica vaginalis, transillumination is an essential method of clinical inquiry.

The second is that hydrocele is a symptom and not a disease.

Transillumination must be adequate. A lighted match is not sufficient for the purpose. A bright electric torch, preferably with the bulb jacketed by means of a piece of indiarubber tubing, is suitable, the room in which the examination is made being darkened. Many and many a bad mistake has been the consequence of neglecting the translucency test.

Here is a rather grotesque example. A patient came one day to my Out-Patient Department and told me that for a long time past he had been troubled with a

[1] *B. M. J.*, July 114, p. 177.

large lump in the left side of his scrotum. At last he decided to consult a doctor, who, after making an examination, told him that the swelling was a "water tumour." The doctor further undertook to remove the fluid. Accordingly he plunged an instrument into the lump and seemed puzzled and annoyed because nothing came out. He then withdrew the instrument, carefully scrutinised the end of it, and put it to his nose. Immediately on doing this the doctor became much agitated, informed the patient that he had made a very serious mistake, and advised him to get into bed at once and to stay there; and warning the patient's wife to be prepared for the worst he hastily left the house. However, the worst did not happen; no harm ensued. And as the doctor never called again, the patient after waiting in bed for a few days got up and came to the hospital for advice. He had, of course, a large scrotal hernia.

Any surgeon who reads this little story may indulge in the smile of superiority. Nevertheless, I have known more than one operator of repute caught napping over the translucency test.

Not only is it possible in the presence of translucency to diagnose the presence of a hydrocele with confidence (except perhaps in certain instances when the patient is an infant), but it is possible also to form some idea of the size of the testicle and to detect enlargement of the organ, and to make certain other observations on the shape, location, and character of the hydrocele which may be of value in connection with both diagnosis and treatment.

As concerns the remark that hydrocele is a symptom and not a disease, this is true enough in spite of the fact that we are accustomed to treat the common hydrocele of middle or old age as though the condition were itself a disease. There is always a danger that we may be content with a diagnosis of hydrocele and fail to make any proper inquiry into the underlying condition of the testicle, the vas deferens, and the other structures of the spermatic cord. Obviously it would be absurd to resect the parietal layer of the tunica vaginalis to cure a hydrocele without observing the gonorrhœal or tuberculous epididymitis to which the hydrocele is subsidiary.

The Tapping of Hydroceles

Tapping a hydrocele is simple enough, but there are certain details connected with the operation which call for remark.

In the first place, the trocar should be of small bore and very sharp; otherwise quite unnecessary pain will be inflicted on the patient. I have on several occasions tapped hydroceles in medical men, and I have observed that these subjects invariably take an acute and apprehensive interest in the size and sharpness of the instrument that is about to be used.

The use of a fine trocar is desirable not only because it causes less pain, but also because there is a lessened likelihood of the complications of sepsis and hæmorrhage following its use. Moreover, hydrocele fluid runs readily through a fine trocar.

So seldom does suppuration follow the tapping of a hydrocele that we may be tempted by prolonged immunity from this trouble into some carelessness as regards our techinque. Nevertheless, suppuration is an occasional and most unpleasant sequel. I have had to open a hydrocele myself for acute sepsis following the ordinary operation of tapping.

Hæmorrhage is a complication which is more common than sepsis, and it may be the cause of an acute *hæmatocele or a hæmatoma in the scrotal tissues.* The risk may be diminished by using a fine trocar, and by taking pains to avoid injuring the scrotal vessels when introducing the trocar—*for these vessels can be seen.* Traditionally an acute hæmatocele arising after tapping is due to testicular injury, but in the one case which has come under my own observation no wound could be found in the testicle or epididymis.

Doubtless trocars have been thrust into the testicle, but such an accident is improbable if due care has been taken to ascertain the character of the hydrocele by *transillumination*, and the trocar is passed inward along a direction indicated by the extent of the translucency. Of course the trocar must not be thrust in too deeply, whatever direction be chosen.

With regard to the operation of radical cure, that is to say, *the removal or at any rate reflexion of the parietal* layer of the tunica vaginalis, one sometimes sees a long scrotal incision made, the hydrocele being delivered intact, the separation of the tunica being carried out by dissection under immediate vision. This method makes

the operation an unduly big affair. A small incision is quite sufficient, the hydrocele being emptied and the parietal layer of the tunica stripped away from the surrounding tissues with two pairs of dissecting forceps.

Swellings of the Testicle

The differential diagnosis of testicular swellings is fraught with importance to the patient and difficulties for the surgeon. Mistakes are not rare, and at times they are tragic. I propose to give a short catalogue of errors, leaving the reader, for the most part, to interpret for himself the morals derivable therefrom.

Torsion of the Testis is a condition which may elude recognition on account of its rarity. There is a common idea abroad in the medical profession that the condition is due to a twisting round of the spermatic cord in the inguinal canal or in the scrotum above the level of the testicle. I suppose the text-books have not made the matter sufficiently clear. At any rate, a correct notion of the lesion being required for purposes of diagnosis and treatment, it may be not out of place to point out that the torsion commonly takes place within the tunica vaginalis and that it is the mesorchium which is involved in the twist.

Late Syphilitic Lesions of the Testicle may sometimes be mistaken for other conditions, although modern methods of diagnosis and treatment have rendered such lapses much less frequent now than was the case a few years ago. One example will suffice, and it is of a rather ancient date.

A man came to the Out-Patient Department of the Seamen's Hospital at Greenwich and told me that he had a tuberculous testicle. I asked him how it was that he knew the nature of his complaint; to which he replied that he has been invalided out of the army with that diagnosis. The army surgeons had removed his right testis. The left organ was not greatly enlarged but it was tender, the overlying skin was a dusky red and adherent to the testicle, and it was clear that a sinus would soon form if affairs were left to Nature. The vas was not obviously thickened or tender. Without carrying my investigations any further I told the patient that the diagnosis appeared to be correct, and that he had better come into hospital. I received rather a check when he responded by asking if I would mind trying some antisyphilitic treatment first, because he had suffered from syphilis and would do anything rather than lose his remaining testicle. He was quite unable to take mercury on account of his having a syphilitic nephritis with copious albuminuria, so that small amounts caused severe salivation. However, under dosage with potassium iodide the testicular lesion completely subsided.

Gonorrhœal Orchitis and Epididymitis

A smooth, rounded general enlargement of the body of the testicle, with or without some amount of hydrocele, is a less common sequel of gonorrhœal infection than is epididymitis, and its significance is consequently liable to be overlooked, and "malignant disease" or some other disastrous diagnosis may be made. The knowledge

that such a condition occurs and the observation of threads in the urine—for of course a routine examination of the urine must be made in all cases of testicular swelling—will lead the surgeon into the correct road.

The same remark applies to gonorrhœal epididymitis. Yet I suppose others than myself have had men sent to them with an epididymitis supposed to be tuberculous in which obvious threads were present in the urine while other features, including the after history, proved the condition to be gonorrhœal. The patient's usual denial of venereal infection is too often accepted at its face value.

It must be remembered, of course, that a non-tuberculous epididymitis may follow infections of the posterior urethra other than gonorrhœal. The introduction of pathogenic organisms by catheterisation is an example in point.

Tuberculous Epididymitis.—The only remark I shall have to make upon this condition is to emphasise the necessity, which lies upon the practitioner who has the care of a case, to think in terms of disease and not to allow his thoughts to be circumscribed by the evident and tangible local manifestation in the testicle.

Staphylococcal Abscess in the body of the testicle has come under my observation on two occasions. The organism in both instances was the Staphylococcus Pyogenes Aureus. Healing rapidly followed incision and evacuation of the pus. No explanation was forthcoming of the path of entry by which the organism reached the testicle, and I suppose the cases are

comparable with those localised infections by the Staphylococcus Aureus which occur in the bones, the liver, and other tissues.

Orchitis as a Complication of Mumps I have never seen. But the following little story is not without interest and moreover has a moral attached. One winter an officer was being treated for parotitis, and being a very restless man, his doctor was unable to restrain him from going out for walks. Then I was sent for because one of his testicles had become swollen. Being aware of the patient's persistent disobedience to his doctor's orders I made a bad tactical error. For without waiting to complete the clinical examination, I started to "pitch in" to him for disobeying these orders, and told the patient he had himself to thank for a very unpleasant complication of mumps. To which he quietly replied, "You don't think the whole thing could be due to gonorrhœa, do you?—because I have been suffering from that all the time"!

Hæmatocele has been referred to in connection with the tapping of Hydrocele. There is one point to be borne in mind, namely, that a hæmatocele is met with occasionally in which there is no obvious underlying lesion of the testicle, while no history of injury can be obtained. In such circumstances a diagnosis of malignant disease is apt to be made unless great circumspection be used. Beyond the characteristic shape there is but little to put us on the right track in such a case at the first inspection.

A hollow needle thrust into a blood cyst or a

sarcoma is apt to evacuate blood. But in the blood withdrawn from a sarcoma it is probable that sarcoma cells will be found by the pathologist. Moreover, the blood from any but a quite recently formed hæmatocele will be altered in colour as compared with normal blood.

CHAPTER XXIX

THE BLOOD VESSELS

A. The Arteries

Diagnosis

Hæmorrhage is such a common sequel of an arterial wound that there is some fear of its usurping the entire field of diagnostic significance. And yet it is not an essential feature. An artery may be wounded without any external and visible loss of blood. The channel of the vessel concerned may have become completely blocked by clot, and this is especially apt to come about if the artery has been completely severed. Or, the accompanying vein having been opened also, the blood ejected from the artery with each pulse will find its readiest escape through the hole in the vein and so back into the general circulation; or, again, the hæmorrhage may take place into the pleura or one of the other large body cavities and so fail to appear on the surface. So that other means of diagnosis must not be ignored, and especially important among these is auscultation over the site of injury. Here, provided that certain precautions are observed, a systolic murmur by itself along the course of the artery will inform us that the vessel

wall has been injured, while a systolic bruit accompanied by a diastolic hum will tell us that both artery and vein have been broached, and that blood is passing out of the artery and entering the vein—a valuable piece of information, for we may be pretty sure that in such a case no hæmorrhage, primary or secondary, will occur. In using the stethoscope in this way certain fallacies may crop up. Firstly, unless gentleness be used, the pressure of the stethoscope itself on a healthy artery may bring about a systolic murmur. This is especially so in the root of the neck. Secondly, a displacement of bone by stretching or otherwise distorting the arterial wall may produce a systolic bruit in the region of the trauma. I have seen a case of fracture of the humerus in which diminution of the radial pulse together with a loud systolic bruit audible over the brachial artery led to a belief that the artery had been damaged. However, extension applied to the limb caused an immediate restoration of the radial pulse and a disappearance of the bruit.

Then, again, in conditions of anæmia systolic bruits may be heard over any large arteries. Their general distribution will serve to distinguish them from the murmurs caused by trauma. The bruits of aortic disease are hardly likely to lead to confusion, nevertheless it may be mentioned that they are conducted up along the carotids and may be heard in some instances by applying the stethoscope to any part of the skull.

The absence of any murmur or arterial beating at the level of a wound, combined with an absence of the

distal pulse, also is of importance, for it indicates complete occlusion of the artery by thrombus. In the absence of external hæmorrhage, no operation will be required merely to treat the arterial injury in such a dry and silent wound.

Secondary Hæmorrhage

The significance of secondary hæmorrhage is so often overlooked, and the consequences of such oversight are so dismal, that the matter cannot be passed over in silence. The fact is that the appearance of arterial blood upon any wound dressings, even though the quantity be small, must be eyed with grave suspicion; and unless the surgeon can satisfy himself that the blood has come merely from granulations, or unless any considerable arterial wound can be certainly excluded, he should at once arrange to open up the wound with a view to dealing with the source of hæmorrhage. I have known instances in which repeated attacks of secondary hæmorrhage have been ignored, with disastrous consequences, merely because the amount of blood lost on each occasion was small. The fact of secondary hæmorrhage is the important one, the amount lost having little if any diagnostic import.

Sometimes we hear the phrase "capillary oozing," and I have known a patient's death ascribed to this cause. A patient has a granulating wound, perhaps an amputation stump, and the granulation tissue bleeds from numerous points. The blood is bright and its escape is continuous or with short intermissions. The

cause is a leaking artery perhaps an inch and a half or more from the surface of the wound. In these cases of "capillary oozing," therefore, it is essential to secure the leaking artery, a procedure which is obvious enough when the nature of the condition is understood—which is far from being invariably done.

Treatment

The Temporary Arrest of Hæmorrhage.—The too common custom has arisen of recommending the tourniquet for the immediate control of arterial bleeding. Though at times an indispensable article, the tourniquet is a cruel remedy, and, apart from its brutality, is not the best means of stopping the flow of blood in the majority of cases. Nature's method of effecting hæmostasis in the presence of an arterial wound consists of vasoconstriction and thrombosis. Clot is a powerful barrier to the escape of blood, and if we can prevent the continual outflowing of blood we shall be helping nature effectually. Therefore, instead of applying a tourniquet we should concentrate upon closing the external wound, which we may do with clamps or towel clips; or, if it is a mere puncture, direct pressure to the wound itself will suffice. If the track is oblique a surprisingly low pressure will be effectual, while if the wound track is at right angles with the plane of the skin, it may be rendered oblique by displacing the skin or rotating the limb.

Occasionally, as, for example, when a compound fracture has been sustained, a tourniquet must be used. In this case morphia will be given, and a note that

cannot be mislaid must accompany the patient to whatever destination he is sent, stating (1) the exact time when the tourniquet was applied, and (2) the amount of morphia given and the hour of its administration.

These details are essential, firstly, because instances have been known in which tourniquets have been applied and subsequently overlooked with a consequence that gangrene has ensued; and, secondly, because patients who are suffering from a recent loss of blood are more than normally susceptible to morphia, and might easily be killed by the administration of a second dose given in ignorance of the former one.

When an individual has suffered from a copious hæmorrhage which for the time being has been controlled by temporary measures, it will be better to defer operative interference until the patient has had time to recover from the stage of collapse. In addition to supplying warmth, fluids, and morphia, it will be advantageous to arrange to transfuse him with blood from a tested donor.

Complete Severance of a Partially Divided Artery.—As a rule an artery which has been cut right across will not be the source of secondary hæmorrhage. The incomplete wounds are the dangerous ones. This knowledge may be used with advantage in dealing with certain cases. For example, a wound of the face causing fracture of the lower jaw is followed by secondary hæmorrhage from the inferior dental artery where it lies in the bony canal. To secure the vessel by ligation in such a case is no simple matter—nor is it necessary.

All that need be done is to manipulate the fractured bone in such a way as to ensure complete severance of the vessel.

Again, in certain deep wounds of the thigh to expose the bleeding point to view may be difficult or practically impossible—that is to say, impossible without inflicting unjustifiable damage to the limb. We know that a muscular branch is at fault, and we therefore make a transverse cut through the muscle proximally to the point where we judge the wounded vessel to lie.

Nevertheless, this plan has but a limited field of usefulness; in most cases ligation is the surgeon's method of dealing with wounded arteries, and in connection with ligation there are several causes of difficulty and disappointment awaiting consideration.

Arterial Ligation.—For a long while it has been an axiom of surgery that in cases of hæmorrhage the vessel concerned should be exposed and tied at the bleeding point. And the axiom is sound. If for any reason it is decided to apply a ligature to the artery at some distance from the wounded spot, a little group of fallacies at once crops up. The wrong vessel may be tied, or having tied the main artery and subsequently having to amputate the limb on account of a resultant gangrene it may be found that the original wound had not involved the main artery, the bleeding having come only from a branch vessel. These accidents I have seen. Specimen W.O. 316 in the Museum of the Royal College of Surgeons is from a case in which the superficial femoral vessels had been ligated for a popliteal hæmorrhage.

to see what a weak barrier the adventitia is against the thumping of an artery of large calibre, and to understand why the large arteries should give way after ligation even though the wound shows no evidence of septic contamination All that is necessary is to bring the vascular walls into contact without causing them injury—a difficult feat unless the pulsations be stopped by securing the artery on the proximal side while the ligature is being applied

Apart from subsequent ulceration of the vessel wall at the point of ligation a recurrence of hæmorrhage after ligation may be due to the fact that we have failed to occlude the artery Catgut is slippery stuff, and with an artery pulsating strongly the first half of our knot may easily slip before we have secured the second half, and as a result the vascular channel remains patent This difficulty is to be avoided by stopping the arterial pulsations while the ligature is being applied

Other causes of renewed bleeding after ligation are—(*a*) slipping off of a loosely tied ligature when an artery is divided and allowed to retract, (*b*) cutting off the ends too closely to the knot so that it comes undone—catgut knots are always treacherous in this way and the ends must never be cut off quite short, (*c*) and perhaps from premature absorption of the ligature if this is unchromicised catgut or other material which is readily absorbed

(2) *Troubles due to Extension of Clot following Ligation* —A constant difficulty with which the surgeon is faced whenever he ties an artery is in the foretelling

how far the resultant clot will extend in a proximal or a distal direction. On one occasion I applied a ligation to the right common carotid artery at a point three-quarters of an inch from its origin, and on the day following I found that complete obstruction of the right subclavian artery had occurred, presumably as the result of a proximal extension of the clot.

But a worse experience befell in a case in which I ligated the right external carotid artery in a patient who was suffering from a gunshot wound. The ligature was applied at the classical spot, that is to say, between the origins of the superior thyroid and lingual branches. On the second day profound left-sided hemiplegia appeared and the patient became comatose and died. At the post-mortem examination it was found that clot had extended in a proximal direction along the external carotid artery so far as to protrude into the common trunk, whence a portion had been detached, presumably, for there was an embolus in the middle cerebral artery. Since then I have always ligated the external carotid above the level at which the lingual arises, tying this separately if necessary.

Léjars in his book on Surgical Emergencies mentions a similar disaster.

(3) *Accidents due to Deprivation of Blood Supply.*—We have here to consider ischæmia and gangrene.

Ischæmia of the Arm or Leg following ligation of a main artery is common enough, and is in most cases easy to recognise by the presence of a rigid paralysis with a characteristic hardness of the affected muscles

the common femoral and the popliteal represent the danger zones, though it is to be noticed that there are *contributory factors*, among which may be mentioned the condition of the patient due to shock and anæmia, and the interference with the collateral circulation by a large wound or by the pressure of a diffuse hæmatoma

Posture may play a part in the incidence of gangrene and ischæmia For example, if the common femoral has been tied and the patient is kept on his back circulation through the gluteal and sciatic arteries will be impeded, while it is doubtful if extension is the posture most favourable to a full and free circulation through the lower extremity Makins is of opinion that ligation of its accompanying vein is of help in the avoidance of gangrene following the tying of a main artery But this should not become a routine For ligation of the main vein, in the lower limb at any rate, is often followed by considerable and lasting disability and discomfort, and should therefore be avoided whenever this can be done *In the case of the superficial femoral artery* for instance—provided that the subject be young and healthy and the collaterals be uninjured—it will be unnecessary to tie the vein because neither gangrene nor ischæmia are to be feared Perhaps in any case the same effects as are produced by ligating the vein may be effected by other methods, that is to say, by lowering the limb concerned or even by applying light circular constriction in order to hinder the venous return of blood

(4) *Inadvertent Damage to Neighbouring Structures while Ligating an Artery*—This is the last cause of

unhappy consequences that I shall have to mention in connection with the tying of arteries. Though I have known the vagus included in a ligature applied to the common carotid, and perforation of the pharynx during exposure of the external carotid, perhaps, as regards its consequences, the worst accident of this kind which has come under my personal observation has been perforation of the internal carotid during ligation of the external. This disaster I have known on three separate occasions at the hands of three different operators, and in each instance the cause was the same. The patients were suffering from gunshot wounds of the neck and face with fracture of the lower jaw. Now, the elevators of the lower jaw are attached entirely to the ascending ramus while the depressors are fixed to the horizontal portion. Consequently, if the horizontal be separated by fracture from the ascending ramus, the the fore part of the lower jaw together with the larynx will fall towards the chest, becoming displaced perhaps one and a half inches below its normal position. Expecting to find the bifurcation of the carotid at the level of the upper border of the thyroid, the surgeon makes his incision much too low down in the neck. Not realising that the anatomical relationships have become altered and abnormal he seeks higher and higher, and by the time he reaches the bifurcation is in such a hurry to get his ligature into place that he does not wait to clear the artery properly or to identify the superior thyroid, but endeavours to thrust the aneurism needle around the artery, and in doing so perforates the internal

carotid close to its origin. Sitting in an armchair at home such an accident may seem very blameworthy. But it is to be remembered that the patient whose carotid artery has to be tied because of hæmorrhage following a gunshot wound is often in a desperate plight, while the conditions in which the operation has to be performed are far from ideal.

Gangrene and Glycosuria.—Before leaving the subject of arterial surgery it may be useful to refer to the common fallacy of supposing that, because a patient who is suffering from gangrene has sugar in his urine, therefore he has diabetes. Gangrene from whatever cause is apt to be accompanied by glycosuria. Even a large necrotic carbuncle may be attended by sugar in the urine. In all such coincidences the surgeon should be guided in his treatment rather by the presence or absence of diacetic acid and acetone in the urine, paying but little attention to the mere presence of sugar. If the patient is not suffering from diabetes the glycosuria probably will disappear with the gangrene. If, on the other hand, he has diabetes, the elimination of diacetic acid from his urine by the administration of carbohydrate food, if such elimination can be achieved, is essential in order to lessen the likelihood of post-operative coma.

B. The Veins

Disasters arise now and then through a mistaken idea that a hæmorrhage is arterial when in truth it comes from a wound in the vein alone. Specimen W.O. 316 in the Museum of the Royal College of Surgeons is an

admirable illustration of this point. Here the loss of blood from a wound of the popliteal vein led the surgeon concerned into supposing that the artery had been injured. Under this misapprehension he proceeded to ligate the superficial femoral artery and vein in Hunter's canal, with the result that the patient died. Now, in this case if the source of the bleeding had been correctly diagnosed no operation would have been necessary, and the patient would not have died as he did; for venous bleeding is readily controlled by pressure and by the limiting power of clot. How, then, is the correct differentiation to be made?

We have to note (1) the colour of the escaping blood, (2) the manner of its emission, and (3) the amount of external pressure required for its arrest. There are fallacies connected with each of these matters; nevertheless, the observations in themselves must be regarded as fundamental and essential, if elementary, exercises on the part of the surgeons. Many a man lost his life in the late war because this truth was not always recognised.

(1) *The Colour of the Escaping Blood.*—Unless the patient be cyanosed, the hues of arterial and venous blood respectively, escaping from systemic vessels, are so very different that any one with a normal capacity for the discrimination of colours can recognise at once from which kind of vessel the stream proceeds. And this is true, provided that the hæmorrhage is recent, even when the flow has ceased and there remains for the surgeon's guidance only the blood which is on the dressings or on

the bed-clothes of the patient. Apart from cyanosis, and apart from the pulmonary circulation, where of course the arterial blood is dark and the venous blood is bright, the only source of fallacy appears to be the simultaneous wounding of an artery and a vein. In practice this difficulty does not often come about. Even when mixed with that from a simultaneous wound in a vein, arterial blood can usually be recognised; moreover, a relatively light external pressure will check the venous loss at once.

(2) *The Manner of Emission of Blood from a Wound.*—When the channel of an artery has been breached in a widely open wound the blood will be seen to issue by jets which are synchronous with the pulse, and the same may occur even in a small punctured wound if the injured artery lie close beneath the aperture in the skin.

If, on the other hand, the wounded artery is deeply situated, and especially if the cutaneous wound is small, while the track through the muscles and fasciæ is oblique, any external bleeding which occurs probably will show little or no sign of intermittent ejaculation, and will be in the manner of a continuous stream. Not once, but many times, have I seen medical men argue in such an instance, ignoring the colour of the blood, that its origin must be a vein. The fallacy is in need of a wider emphasis than it has received hitherto.

Moreover, a venous hæmorrhage may display an undulating flow. The relatively slow respiratory rhythm that is seen in venous hæmorrhages, especially with injuries occurring in the root of the neck, is easily

distinguished from arterial pulsation by any one who has not lost his power of perceptive cerebration. But it may be worth while to mention that blood may issue from a wounded vein in jets which are synchronous with the pulse. These jets differ in character from the vicious ones that proceed from a wounded artery, and consist rather of intermissions in the gentle flow. John Hunter observed this phenomenon and endeavoured to discover its cause, but since his day the matter seems to have attracted little or no attention, although I suppose it has come under the observation of every practical surgeon. The veins of the brain and feet are those concerned; the cause may be identical.

(3) *The Amount of External Pressure required to effect Hæmostasis.*—As a diagnostic aid the effect of applying light pressure over a wound has its uses, for venous bleedings are easily arrested by such means. Nevertheless, some circumspection is required even here, for in the case of a punctured artery with an oblique wound track passing through the deep structures, but little external pressure is required to effect a temporary arrest of the blood-flow. Yet, provided that the external pressure be maintained for a period sufficiently long to allow clotting in the case of a venous wound the hæmostasis almost certainly will be permanent, while a recurrence of bleeding should lead to grave suspicion regarding the integrity of the arteries.

In the treatment of venous hæmorrhage it is of great service to remember that the clotting of blood requires time. We should avoid, therefore, " dabbing," the wound,

and instead we should maintain steady pressure for six or at least five minutes *timed by the watch.*

Many opportunities arise for the application of this principle. Epistaxis is one of these. I have yet to come across a case of nose bleeding which cannot be effectually treated by pressing the ala nasi against the septum and by maintaining that pressure without relaxation for six minutes timed by the clock. When we consider how painful to the patient is the process of plugging the posterior nares and how heavily fraught the operation is with the dangers of acute otitis media and infection of the sinuses which open into the nose, the value of a simpler and safer method will be readily appreciated.

Another kind of case in which the method is useful is that in which bleeding occurs from a new growth which is found, during an operation, to be too extensive for removal. To save the patient in such circumstances from post-operative pain and also from fungation of the tumour later on, it is far better to stop the bleeding by the method explained above, and to close the cutaneous and fascial coverings completely, than to insert plugging which subsequently will have to be removed, and which will necessitate the sequel of an unclosed wound.

Reference will be found on other pages to the inconveniences and dangers which may arise from wounds of veins during operation, and it will be unnecessary to enlarge upon this matter further than to remark that ligation is the remedy of choice in the large majority of venous wounds, owing to the danger of thrombotic

embolism which is inseparable from the treatment of the injured vessel wall by suture or by what has been called the "postage-stamp" method. There are instances, of course, where the danger of this complication must be run deliberately, but there is little excuse for such a risk when it is incurred casually and without forethought.

Thrombotic Embolism

The clotting of veins in the field of an operation and subsequent cardiac or pulmonary embolism seems to be a less frequent complication of surgery now than it used to be, and this improvement may be attributed to a betterment of surgical technique, for there is little doubt that such thrombosis is largely attributable to sepsis. Nevertheless, it is to be remembered that a milk diet, which at one time was a common if not usual feature of the after-care in surgical cases, is favourable to the formation of clots; and the more modern methods of feeding sick people may have played an active part in reducing the dangers of cardiac and pulmonary embolism.

Septic Phlebitis

When we consider that in the British Base Hospitals in France during the late war, the chief cause of death following wounds of the limbs was septic phlebitis and its complications, we can appreciate the importance of the subject to the surgeon. And yet there seems to be a scotoma in the field of medical vision which persistently

obscures the subject. The niagara of surgical writings that had their fountain in the great conflict hardly contain a reference to the infection of veins. And in peace as in war this same obscuration is present. Why?

Probably the fundamental explanation is that post-mortem examinations, while involving a thorough investigation into the naked-eye conditions of the chief viscera, do not commonly include a fine and detailed investigation of the structures in the neighbourhood of septic focuses.

As a consequence of this the clinical features of septic phlebitis remain unknown to the majority of medical men. It is true that infective thrombosis has received special notice in connection with diseases of the uterus and the middle ear, but there are special reasons why clinicians generally have not derived much practical advantage from these studies; nor do the text-books give much help. Suppose that the common femoral be infected, the clinician must not expect the thrombosed vein to be recognisable by palpation, to find redness of the overlying skin, œdema of the leg or definite tenderness along the course of the vessel. Some of these signs may or may not be present; their absence is in nowise reassuring.

Even when the condition has been recognised, its treatment calls for the avoidance of certain fallacies. The first of these is dependent upon the extent of the infection. On finding a vessel filled with septic clot up to a certain level—which probably will coincide with the influx of a tributary—a natural impulse will arise

to ligate the vessel a little way above, that is to say, on the cardiac side of the clot. Such a procedure is likely to be fruitless of good results; for infection, as a rule, extends along the vein for a considerable distance in advance of the visible and palpable clot.

Thus a transperitoneal ligation of the external iliac vein carried out on account of septic phlebitis of the common femoral vein probably would fail to arrest the process even if it did not cause an acute peritonitis. This was learned by some of us through unfortunate experiences, and our own experiences were of necessity our only guides, for the text-books greatly err on this matter. In practice a proximal ligation was of use in staying the disease only if it could be performed at a point far removed from the site of thrombosis, and this means that the diagnosis must be made at an early stage. In all other cases, drainage of the infected segment without proximal ligation seems the only hope. It follows too that in case of thrombosis of the lateral sinus due to middle ear disease, the internal jugular vein should be ligated low down in the neck in order to get beyond the reach of sepsis.

Varicose Veins

Operations upon varicose veins are among the unsatisfactory classes of surgical work. Owing to the wide extent and distribution of the lesion, it is not always practicable to remove all the visibly dilated veins, so that to the patient the operation is incomplete. Moreover, the disease itself being a progressive one, fresh

varicosities may appear subsequently, and the patient considers that he has a recurrence. So that, at the best, it is not fair to regard surgical interference as carrying any greater effect than palliation.

Further, it is regrettable, but true, that the patient is sometimes rendered worse by the surgeon's work. Such bad results, I think, are most likely to follow extensive operations accompanied by ligation of the internal saphena vein in Scarpa's triangle. In some instances they are the direct consequence of a thrombosis extending in a proximal direction from the point of ligation until the common femoral vein itself becomes blocked by clot. I have seen more than one example of this unpleasant sequel of the operation of ligation of the internal saphena vein in Scarpa's triangle, though I would not on this account urge that such ligation is never justifiable. Precautions available against this complication are, (1) the strictest surgical technique in order to avoid even the mildest infection, and (2) the application of ligatures at a lower level in the thigh than is the usual practice. Of course, it is convenient to tie the vein high up, because by exposing it at this level the inner and outer femoral cutaneous tributaries can be secured through the same transverse incision. These veins may be large, and I have known one of them to be mistaken for the internal saphena itself, so that after the operation the latter was perfectly obvious when the patient stood up, running an untrammelled course parallel to the vertical incision which the surgeon had made.

A word of caution is not out of place with regard to

varicose ulcers. It is not uncommon to see an ulcer of the leg with a large varicose vein just above; the surgeon may regard ligation of that vein as a rational procedure. And so it will be if the operation can be performed without any risk of causing a septic phlebitis. And to achieve this immunity he has not only to avoid contamination of his wound from the ulcer itself, but he must have an area of clean, uninfected skin through which to make his incision. To cut through a reddish-copper coloured area of cutis in order to apply his ligature is to run into the danger of septic phlebitis and pyæmia.

Personally, I think it wise when tying a vein to use fine absorbable material, and to use a force sufficient only to secure occlusion of the vessel without damaging its walls.

Air Embolism

No treatise upon the accidents of surgery would be complete without some reference to the danger of air gaining entry into a vein which has been opened during an operation. This peril is threatened only in connection with wounds of the base of the neck and upper thorax. The dangerous area can be marked out by two semi-elliptical lines drawn from one axilla to the other, one line passing above and the other below the clavicle.

The chief practical point to remember when warned by the characteristic whistling sound that accompanies the suction of air into a vein is to avoid all compression of the vein distal to the venous wound. So long as blood is not prevented by distal pressure or ligation from

reaching the breach in the vessel wall, little or no air will find its way into the blood stream. The immediate aim of the surgeon's finger must not be so much to check the bleeding as to stop the entry of air, and it should therefore be directed in the first instance *to a point on the* proximal side of the vascular wound. On no account should he be diverted by the bleeding into applying any proximal pressure until either the aperture in the vessel wall, or the vein itself on the proximal side of the wound, has been secured.

Occasionally the apex of the pleura is wounded during operations on the neck, and the sounds produced by air whistling in and out of the chest cavity in such an event might for the moment be misinterpreted as due to air entering a vein, though of course a few seconds of deliberation would suffice for a correct estimate of the injury.

CHAPTER XXX

INJURIES AND DISEASES OF THE SPINE

Beyond the remark that fractures of the spine are, now and then, the subjects of surgical oversight, there is not a great deal to be said so far as their diagnosis is concerned. The impression still seems to be prevalent, even amongst members of the medical profession, that a man who has just sustained a broken neck will not be able to walk about. The fact that he often can and does so walk about is answerable for failures in diagnosis.

But it is in the treatment, rather than in the diagnosis, of fractured spine that most errors are to be observed. The desirability of securing rest and fixation of the broken bones is manifest, and in cervical fractures can be secured by means of a Plaster-of-Paris support. But if the fracture is lower down and especially if the patient be grown up, we may be unable to supply any other support than a firm bed, and so fracture boards should be placed under the mattress. Yet one supposes that in the teaching of students and nurses a water-bed has been recommended for these cases, for it is commonly used. The water-bed does not afford a sufficiently steady support.

A dangerous fault in the treatment of paraplegia, whether due to injury or disease, is to make use of catheters in order to empty the bladder which the patient cannot empty for himself. If this be done the

and in cases where little virulence is shown either by local inflammation or constitutional disturbance, we may be justified sometimes in repressing our ideal, in reluctant deference to the patient's purse. But in every bacterial attack we should at least desire to know with what organism we have to deal; such knowledge is essential when local and general inflammatory reactions are pronounced.

Surprises will be in store for those who follow out the principle thus laid down, and their professional capacity will be placed upon a higher plane. They may gain the satisfaction of rapidly curing a diphtheritic whitlow by means of the appropriate antitoxin, or the ability to prophesy the course of a pneumococcal cellulitis, or the faculty to deal in a competent manner with a gonorrhœal stomatitis, an anthrax pustule, or an actinomycotic abscess in the neck. But apart from such rarities we ought to know which of the more common organisms is the cause of mischief in an ordinary case; and in the future, seeing the work that is in progress on the specific action of different antiseptics on various micro-organisms, the knowledge is likely to be of even more value than it is now. Nevertheless, even to-day the surgical treatment of certain local infections, an infected pleural effusion or a septic arthritis, for instance, will be profoundly influenced by what the invading organism is proved to be.

In opening an abscess care must be taken not to plunge the knife through the abscess, through the protective barrier around it, and so into innocent tissues

beyond. This caution is particularly necessary in cases of whitlow, and it is possible, and I think probable, that most instances in which infection of tendon sheaths or sloughing of tendons takes place are attributable to a clumsy use of the knife. If deep incisions are called for in a case of whitlow they should always be made into the side of the finger and not, as so frequently is done, into the mid-line of the palmar or dorsal surface.

Another source of unsuccess is to open a superficial pocket of pus while leaving undrained a deeper focus of suppuration with which the former pocket is pathologically connected. An example of this is to open an abscess over the mastoid bone and to leave the bone itself intact, although the major trouble is in the antrum and the mastoid cells. Another illustration is the so-called acute periostitis of a long bone. An incision is made, and pus is found between the bone and its periosteum, and the surgeon does nothing more. Then follows extensive necrosis of the bone, septic arthritis from direct extension into a neighbouring joint or pyæmia. Many a life and many a limb is lost every year through this mistake—a mistake which is due mainly to the fact that the disease itself has been misnamed in the past. The term "acute suppurative periostitis" should disappear. The disease is osteitis, and when osteitis is accompanied by suppuration there are two places in which the pus can and will collect, namely, between the periosteum and the bone, and in the medullary and cancellous spaces of the bone itself. Therefore in every case in which pus is found beneath the periosteum it is

CHAPTER XXXII

MALIGNANT DISEASE

PITFALLS of various kinds abound in connection with malignant disease A failure to recognise the real significance of pre cancerous and early cancerous conditions is one of the commonest of these There are certain regions in which these early cancers and pre cursors of cancer often are manifest to the careful practitioner, notably the tongue, the female breast, and the uterus And yet how frequently it happens that a wart or a chronic fissure of the tongue, even in the presence of advanced leucoplakia is allowed to persist without any treatment at all, or if treated, is dealt with inadequately and without finality ?

Local excision without loss of time, followed by microscopical examination of the tissue which has been removed is essential in these cases, and there can be no excuse for failing to recommend this course to the patient In quite a large proportion of the instances in which this measure is adopted early malignant disease will be revealed, and the patient will be able to undergo a radical operation with an excellent prospect of permanent eradication of the disease

In the female breast it must be recognised that

so-called cystic mastitis, galactocele, and adenoma are not infrequent forerunners of malignant disease, and, at any rate in women past forty years of age, similar treatment by excision and microscopical examination is the only safe course. And the same remark is applicable to erosions of the cervix uteri. It is probable that every experienced surgeon who reflects can bring to mind some melancholy examples of what may happen from the neglect of this golden rule.

The next point to be emphasised is the necessity for having a microscopical examination made of every tumour removed by operation, however simple it may appear, or from whatever region of the body it has been taken. Such examinations entail a little trouble and expense, but they are necessary.

I was consulted by a lady who suffered from advanced carcinoma of the breast. There was a small scar over the affected region. Her doctor told me that this was an operation scar, and that he had removed an adenoma from the breast two years previously. The growth having been encapsuled and "obviously non-malignant," he had not sent it away to be examined. In another instance a boy came to the Casualty Department of a hospital with what was supposed to be a small nævus in his forearm. The house-surgeon removed the growth under local anæsthesia. Later on the boy presented himself with recurrence in the vicinity of the scar. Still thinking that he was dealing with a simple nævus, the house-surgeon again performed a local excision. On neither occasion did he see any necessity for a micro-

scopical examination. On the patient's third application to the hospital some months later it was found that he now had a fungating growth on the forearm, enlarged glands in the axilla, while secondary deposits were present in his lungs. The growth was a malignant melanotic tumour.

Yet another slip is by no means rare, and this is to mistake a secondary deposit for a primary growth. The results are less tragic, perhaps, than those which follow upon the foregoing errors. Nevertheless, they are discomfiting mistakes and attention must therefore be directed towards them. Perhaps the most common example is the removal of a malignant ovarian tumour under the impression that it is a primary growth, whereas it is in fact secondary to carcinoma of the stomach or of some other organ. Not infrequently also is a secondary deposit in a bone regarded as a primary sarcoma, and this will prove a particularly unfortunate mistake if it leads to amputation of the limb. To maintain that this pitfall can always be avoided would be absurd; but certainly it is not invariably quite excusable. By bearing in mind the possibility and by making a complete and careful survey of the patient, the surgeon may sometimes escape the snare which otherwise is sure to make him captive.

Cognate with the foregoing misadventure is the attempt at radical extirpation of a primary growth, when secondary deposits already are present. In this event the patient may be put to much misery by an extensive operation to no good purpose.

A man had a tumour in his abdomen. On exposure by laparotomy this was found to be a carcinoma of his descending colon. The surgeon performed an elaborate and skilful excision of the affected portion of the bowel, completed an intestinal anastomosis, and was about to sew up the wound when the patient's doctor who was present asked him to examine the liver. This he did, and found it occupied by metastatic deposits.

Palliative measures in inoperable cases of malignant disease appear to be somewhat neglected. Extensive operations for the relief of the patient's distress are quite justifiable even when a cure is not to be expected. The progress towards death from secondary growth in the mediastinum or lungs is not as a rule quite so distressing to the sufferer or to his relatives, as it would be in the presence of an ulcerating, surface cancer; while section of nerves, for example of the inferior dental and lingual in cases of advanced buccal cancer, may be of real benefit to the patient. The matter is hardly worth mentioning perhaps in a discussion of mistakes, except to call attention to the fact that the surgeon has not always to limit his thoughtfulness to the simple question of whether a radical extirpation of the malignant growth is or is not reasonably possible.

Dissemination of Malignant Disease by Operation

A precaution to be observed in all surgical procedures for the removal of malignant growths is to avoid local dissemination of the cancerous material in the wound.

To achieve this we must refrain most especially from cutting into the primary growth itself or into lymphatic glands and other tissues which have become involved. Thus, in removing a mammary carcinoma we should take away the breast, together with the surrounding tissues, including the pectoral muscles, so far as possible entirely in one piece. That is to say, all the active dissection required should be beyond the confines of the growth. This principle must be followed if good after results are to be obtained.

Sarcoma of Bone

Periosteal Sarcoma

If questioned as to the correct treatment for a periosteal sarcoma affecting one of the limbs, the natural impulse of a surgeon is to answer " amputation." And so far as the hypothetical case is concerned, this impulse may be right, and the text-books also, from which it emanates, may be right. Nevertheless, in actual practice there are at least two reasons for hesitation before recommending such treatment to a patient who is thought to have a periosteal sarcoma.

(1) *The Fallacy of Uncertain Diagnosis.*—In the first place, the practitioner has not a sure diagnosis from which to start. He has not a hypothetical case of periosteal sarcoma to treat, but a patient who has a swelling which seems to be a periosteal sarcoma. The surgeon who leaps hastily to the conviction that the swelling is without doubt a sarcoma, and who strides on with equal confidence to perform amputation, may do

irretrievable mischief. Doubtless, such assurance and incisive determination convey a favourable impression to the lay mind; and for this reason we must exercise special self-restraint in order to keep clear of the temptation that naturally arises from such a source.

Many and many a limb has been amputated in error, and a supposed periosteal sarcoma has been found to be inflammatory swelling, gumma, callus, bone cyst, or some other innocent formation.

With care some of the sources of error may be removed, but in the early stages there is ever present the shadow of uncertainty.

A complete examination of the patient is, of course, essential; and the presence of secondary deposits or of multiple lesions especially must be sought. If dissemination has already taken place all hope of effecting a cure by amputation has passed away. When more than one bone is affected, the disease is nearly sure to be innocent, because multiple sarcomata of bones are rare, whereas tuberculous and syphilitic inflammations frequently affect more than one bone at the same time, while cysts and other innocent tumours are not rarely multiple. The clinical history, too, needs careful investigation. An examination of the blood should not be omitted. Good skiagrams are of great value, although even they are not infallible.

A microscopic section of the tumour is an aid towards certainty, although a laboratory diagnosis is not to be accepted without reserve. Moreover, the practice of cutting a piece out of a malignant tumour for micro-

scopical examination is open to objection, as dissemination of the tumour by this means is believed to be a real danger.

In brief, by means of scrupulous care in examining the patient the chances of error in diagnosis may be diminished, but they cannot be excluded entirely.

(2) *The Disappointing Results of Amputation.*—The second reason for hesitation before recommending removal of a limb affected with periosteal sarcoma is that the results of amputation in these cases are disappointing. Experience has shown that a cure by this means is unlikely; sooner or later secondary sarcomata appear and destroy the patient. It is true that the prognosis after amputation varies to some extent with the position of the primary growth. If the femur or the humerus be the seat of the growth, the hope of saving the patient by amputation is extremely small; in the case of the femur it is so small as to be negligible. As a palliative the operation may have some use now and then, but as a curative agent it has but little value, and such value as it has can hardly be more than enough to counterbalance the possibility of erroneous diagnosis. With more distally placed growths the prognosis is better, but it is still bad.

To sum up, it may be stated that a patient with a periosteal sarcoma of his femur is not likely to derive benefit from an amputation through the hip-joint. If the humerus be affected, life may be prolonged by removal of the limb, but recurrence of the growth is to be anticipated. With periosteal sarcoma of one of the

other long bones probably life will be prolonged, and possibly a permanent cure will be obtained.

Incidentally, it may be remarked that the majority of all cases occur in connection with the femur or the humerus.

On the other hand, not a few cases are on record in which a patient supposed to be suffering from periosteal sarcoma has not been submitted to amputation and yet has recovered. This, and the fact already mentioned that several limbs have been amputated for a supposed sarcoma which did not exist, should be sufficient to set the surgeon in deep thought before recommending amputation for a supposed periosteal sarcoma.

Endosteal Sarcoma

Difficulty of correct diagnosis applies at least as much to endosteal as to periosteal sarcoma, and it will not be out of place to mention a few cases in illustration. Radiograms need skill, not alone in their manufacture, but also in their interpretation. Even the experts, however, are not immune from error.

A man [1] of twenty-three years fractured the middle of the shaft of the femur. The injury was slight, but there had been no previous symptom of morbidity in the bone. Union occurred with some deformity. Two years later there was considerable swelling at the site of the fracture, crackling could be obtained upon pressure, and there was a sense of fluctuation. A radiograph taken at this time showed what was regarded as a simple

[1] Elmslie, *Brit. Jour. Surg.*, Vol. II. p. 44.

scopical examination is open to objection, as dissemination of the tumour by this means is believed to be a real danger.

In brief, by means of scrupulous care in examining the patient the chances of error in diagnosis may be diminished, but they cannot be excluded entirely.

(2) *The Disappointing Results of Amputation.*—The second reason for hesitation before recommending removal of a limb affected with periosteal sarcoma is that the results of amputation in these cases are disappointing. Experience has shown that a cure by this means is unlikely; sooner or later secondary sarcomata appear and destroy the patient. It is true that the prognosis after amputation varies to some extent with the position of the primary growth. If the femur or the humerus be the seat of the growth, the hope of saving the patient by amputation is extremely small; in the case of the femur it is so small as to be negligible. As a palliative the operation may have some use now and then, but as a curative agent it has but little value, and such value as it has can hardly be more than enough to counterbalance the possibility of erroneous diagnosis. With more distally placed growths the prognosis is better, but it is still bad.

To sum up, it may be stated that a patient with a periosteal sarcoma of his femur is not likely to derive benefit from an amputation through the hip-joint. If the humerus be affected, life may be prolonged by removal of the limb, but recurrence of the growth is to be anticipated. With periosteal sarcoma of one of the

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Endosteal Sarcoma

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[1] Elmslie, *Brit. Jour. Surg.*, Vol. II. p. 44.

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cyst. An *exploratory operation* was performed. Two large cysts were opened; they possessed thick fibrous walls, and contained clear straw-coloured fluid. Seven months later there was pronounced swelling of the femur and fluctuation was obtained. Another radiograph was taken, and an operation was commenced with the object of removing completely the affected part and putting in a graft. It was found, however, that around the cyst a solid white growth was infiltrating the muscles. Microscopic examination showed that the growth was a spindle-celled sarcoma with some giant cells.

The converse of this mistake is recorded by Lockhart Mummery.[1] The patient was a little girl aged eight years, and the X-ray photographs showed what appeared to be endosteal sarcoma in the upper end of the humerus. Not until the arm had been amputated was the swelling discovered to be a simple cyst.

We must accept, therefore, the fact that it is not always possible to decide by means of radiograms whether a tumour of a bone is an endosteal sarcoma or a simple cyst. An eminent radiographer, Dr. A. C. Jordan,[2] has stated that the only way of distinguishing between cystic disease and myeloid sarcoma of a bone is by a microscopical examination.

Unfortunately even the *microscope* is not always to be trusted as a guide. But it is a help, and should be made use of unfailingly in all these cases. The diagnosis

[1] *Trans Roy. Soc. Med., Clinical Sect.*, 1910, p. 195
[2] *Loc. cit.*

cannot be made by one method of investigation alone. A knowledge of the pathology of bone tumours, of the usual sites of their occurrence, the ages at which the different kinds of tumour are most frequent, a complete clinical examination of the patient, good radiograms with expert interpretations, microscopical examination of the doubtful tissue, these should all be brought into use before recommending a patient to have his limb amputated on account of a swelling of the bone. In the absence of radiograms and microscopical investigations innumerable mistakes have been made. Any of our pathological museums can show examples. There one can see limbs amputated which were the seat of gumma, tuberculous osteitis, callus formation, simple cysts, and other innocent swellings. They tell a tale of disaster which might well make the surgeon despond, were he without guidance toward those principles by the practice of which such perils are to be avoided.

A common treatment for a bone cyst or for a myeloma, if not too far advanced, is curettage. But even this simple procedure is not without its dangers, for Bloodgood [1] records cases in which severe hæmorrhage followed the operation. In one of these the patient bled to death, in the other the patient was saved only by amputating the affected limb.

An error which is not infrequently made is to mistake a sarcoma growing near the end of a long bone for arthritis. Butlin and Colby [2] state that out of twenty-

[1] Quoted by Elmslie, *loc. cit.*
[2] *St. Bart.'s Hosp. Rep.*, Vol. XXXI. 1895.

anæsthetist had been using two small drop bottles; when one was empty, a nurse filled the second one and handed it to the administrator. Inadvertently the nurse had replenished the bottles with chloroform instead of with ether.

In another case chloroform instead of ether was placed in a Clover's inhaler, with immediate peril to the patient.

A common habit amongst anæsthetists is to verify the anæsthetic by the sense of smell before offering it to the patient, and the practice is commendable. The nose, however, is not always to be depended upon to give correct information on the matter. After inhaling anæsthetic vapour for a considerable period of time it may be quite impossible to distinguish ether from chloroform by the unaided sense of smell. Additional precautions therefore are requisite. The drop bottle used for ether should be larger and of a shape distinctive from that used for chloroform; it should be replenished by the anæsthetist himself, and should be emptied of its contents at the end of each operation.

A well-practised anæsthetist was chagrined by his inability to render a patient unconscious within a reasonable period by means of nitrous oxide gas, and he passed some puzzled moments before he found that he had been offering her pure oxygen, having turned on the wrong cylinder by mistake.

Serious and occasionally fatal[1] accidents have occurred owing to the wrong adjustment of the rubber tubes to

[1] *Lancet*, July 21, 1917, p. 97.

a Junker's inhaler, with the result that chloroform has been squirted in bulk into the patient's mouth. To avoid this misfortune, care should be taken that the bottle of the Junker's apparatus is only one-third filled with chloroform, and that the rubber tubes are properly attached to the chloroform bottle; and to ensure that these details are correct, a good practitioner always will test the working of the apparatus immediately before utilising it upon the patient. There is little necessity to remark that the chloroform container must not be inverted during the administration.

One especial danger may be alluded to here, namely, that which ensues from the application of adrenalin to a patient who is under light chloroform anæsthesia. That the association of these two drugs may be dangerous was first communicated to me by Mr. E. H. Drinkwater, and I have since become aware from other sources of cases of sudden and unexpected death during operations in which the two drugs were used simultaneously.

Certain minor ills attributable to the direct contact of ether or chloroform with the patient's skin are not infrequent. " Burns " of the face due to a mask wet with chloroform remaining in contact with the patient's cheeks or nose are quite common. They are to be avoided by taking care to prevent the wet part of the mask from resting on the patient's skin, by using a gamgee mask with a hole in it leaving mouth and nose free, or by applying vaseline as a protective to the patient's face at the vulnerable places.

In giving ether by the open method it is quite

possible to cause frostbite of the cheeks through the prolonged pressure on them of the frozen mask, instances of which are not unknown. To avoid this, when much freezing occurs on a mask, a towel wrung out of warm water should be applied occasionally.

One has seen, now and then, during the induction of anæsthesia, a drop of chloroform fall into the patient's eye, a little mishap which is painful to the patient and disconcerting to the rest of those assembled.

A curious complication due to the action of ether upon the conjunctiva occurred in my own Out-Patient Department. A boy who had been operated upon for enlarged tonsils and adenoids on a Wednesday was brought to me again on the following Saturday with hæmorrhagic conjunctivitis affecting chiefly the inner halves of each eye. On investigation it was found that the ether inhaler which had been used was defective, inasmuch as the guard on the inside had become partially detached, and the presumption was that some ether had trickled down through the fissure into the patient's eyes.

A practice which is to be deprecated is the frequent insertion of a finger into the patient's eye in order to test his corneal reflex. Not only is such a practice unnecessary, but it is not beneficial to the delicate epithelium of the cornea. An even more potent source of injury to the cornea is the desiccation that occurs during prolonged operations when the patient's eyes remain open. As with all unconscious patients, so in those under anæsthesia, if the eyes cannot be kept shut

the upper lid should be pressed down over the cornea at intervals so as to moisten it, and a drop of castor oil should be occasionally applied to the conjunctival sac.

Instances have occurred of ignition of ether vapour during an operation owing to proximity of a naked light, and the danger is one that should not be overlooked. I have myself seen an accident from this cause. The patient was being anæsthetised with nitrous oxide and ether, oxygen being supplied at the same time. When removing the inhaler from the patient's face for some purpose the anæsthetist inadvertently passed it near a spirit lamp which was being used to warm the vapour as it passed through the anæsthetising apparatus. The resulting flames were quickly extinguished by a blanket and the patient merely sustained some superficial burns.

I know of two instances in which the operator has been "gassed" by the decomposition products of chloroform, set free by the chloroform vapour coming into contact with a hot stove. In one case, in which I was the operator, I had the utmost difficulty in completing the operation owing to profuse lacrimation, which dimmed my vision, and to laryngeal irritation. The heating apparatus used in the room in this case was a coke stove. In the second case, an oil stove of which the top had been allowed to become "red hot," caused the same symptoms of lacrimation and laryngeal irritation, and, more than that, both operator and anæsthetist fell unconscious to the floor. A nurse was present and

was not so much affected, and so was able to save the situation by opening the window and dropping the patient, who was a child, out into the open air, and by means of ventilating the room to bring about a return to consciousness on the part of the operator and anæsthetist.

Suffocation

I suppose it will be granted that one of the chief sources of danger to an individual who is being anæsthetised by one whose experience is not large, is suffocation. Many times does one see unnecessary delay on the part of inexpert anæsthetists in turning the patient's head to one side, thrusting forward his jaw, and if needs be drawing forward his tongue or inserting an artificial airway. Why is it? Why, also, should the primitive instrument with two blades which squeeze and crush the tongue, still be called a tongue forceps, and still be used for that purpose? The only tongue forceps permissible are those which transfix the tip of that organ, for these do not cause the patient subsequent pain; whereas the old-fashioned gripping forceps add considerably to the patient's cup of misery when he recovers from the anæsthesia.

As a matter of fact tongue forceps are seldom required; for the best way of drawing forward the tongue in sudden emergencies is by inserting the index finger and pulling forward the tongue by applying pressure to it just above the epiglottis. And to maintain a free passage of air through the mouth and pharynx

a Hewitt's artificial airway is efficient and at the same time innocuous.

An axiom of the oral administration of anæsthetics is to the effect that nothing should be allowed to impede respiration. Inspiration and expiration of air should be perfectly free, and any partial suffocation such as I have mentioned is a source of danger. And with this end still in view pains should be taken that no tight article of clothing be allowed to hinder the movements of the chest; and especial care should be used to cut through bandages which are round the patient's neck before commencing to administer the anæsthetic. Sometimes the functions of respiration and circulation are embarrassed by placing a patient in the Trendelenburg position, owing to the pressure of the viscera upon the diaphragm, and this embarrassment will be increased if the patient's arms be maintained in a position of abduction or flexion. For a patient does not breathe freely with the arms in this position. In order that his respiratory excursions may be full his arms should lie alongside of his body. And it should be noted that the lithotomy position also is sometimes not borne well, especially by stout and elderly patients who are apt to show signs of venous congestion and to become cyanosed when placed in this position.

All these causes of partial suffocation being provided against, it is important to prevent actual blockage of the air passages by the inhalation of foreign bodies. False teeth should be removed before the administration of an anæsthetic is commenced, and care should be

exercised with regard to loose milk teeth or adult teeth which have become loosened by disease, and if these are present especial heed must be taken if a gag is used. I have heard a well-to-do patient speak in disparaging terms of the "roughness" of two doctors because a loose milk tooth became dislodged during the insertion of the gag in an operation performed upon her child for the removals of tonsils and adenoids.

During dental extractions it occasionally happens that the whole or a part of a tooth finds its way into the air passages with evil consequences, immediate and remote, and specially constructed forceps have been designed to minimise this danger. A Buxton's spoon is a useful and efficient instrument with the same object in view. With regard to false teeth becoming displaced during anæsthesia, they are more likely to pass into the pharynx and œsophagus than into the larynx and trachea, and apart from causing immediate symptoms of suffocation, they may give rise to very grave troubles by lodging in the œsophagus, stomach, ileum, or other portion of the intestinal tract.

Dental props are potential sources of danger, as they may become displaced and find their way into the patient's pharynx. To prevent this it is usual to use dental props in pairs, which are connected together by a piece of tape or string, and the danger is in this way overcome. In any case no dental prop should be used without some sort of attachment which will prevent its being swallowed and which will facilitate its removal if it becomes displaced.

When, during anæsthesia, a patient becomes cyanosed and ceases to breathe, so that artificial respiration is called for, it must be remembered that three things need to be done, namely, (1) to open the patient's mouth, (2) to pull forward his tongue and jaw, and (3) to perform artificial respiration. These three necessary actions should be performed always in the order just given. Yet how often do we see the order reversed and the movements of artificial respiration methodically carried out while the air passages are still blocked so that no air can pass into the patient's lungs, precious time being thereby lost.

In addition to false teeth, other loose bodies may be the cause of suffocation, including tonsils and adenoids which have been detached, and material that has been vomited.

Retropharyngeal Abscess

One particularly interesting cause of suffocation during anæsthesia is retropharyngeal abscess; it is apt to be overlooked and the oversight causes disaster.

I was requested to help a general practitioner perform an operation for suppuration in the glands of the neck of a child who had been suffering from scarlet fever. As soon as the child was under the anæsthetic and before an incision had been made she stopped breathing. I put my finger into the patient's mouth and found a retropharyngeal abscess, the opening of which relieved the obstruction to respiration.

In another case, during an operation for adenoids

in which the child stopped breathing, the operator inserted his finger into the mouth without detecting the abscess. I was hastily summoned from an adjoining room to perform tracheotomy; however, I happened to discover the abscess and to relieve the immediate symptoms by letting out the pus, though the child died subsequently from septic broncho-pneumonia.

As a rule in cases of retropharyngeal abscess, the difficulty of breathing may be relieved temporarily by flexing forward the child's neck, a hint which may be worth the remembering.

A curious case of suffocation during anæsthesia, requiring tracheotomy for its relief, is related to me by Mr. E. H. Drinkwater. A dull-witted boy of about seventeen years was anæsthetised with ethyl chloride for the removal of tonsils and adenoids. No sooner had one tonsil been removed than respiratory obstruction occurred, which was not due to inhalation of the tonsil. Tracheotomy was performed and the boy recovered. Careful investigation subsequently revealed that the boy was suffering from myxœdema, with swelling of the epiglottis, soft palate and ventricular bands, so that the glottis was much encroached upon.

Inhalation Pneumonia

Apart from the risk of suffocation by inhalation of gross foreign bodies, an unconscious patient runs a hazard of less bulky septic material being drawn into his air passages with the possible consequence of septic pneumonia, as in the case I have just mentioned of

septic pneumonia following operation on a retropharyngeal abscess. And whenever an anæsthetic has to be given to a patient who has a septic focus communicating with the mouth, pharynx, or air passages, this danger must be kept in sight, and every endeavour made by arranging him in a correct posture, by swabbing and by other means to avoid this inhalation of septic material. A preliminary dose of morphia should not be given in such cases. Using as light an anæsthesia as is compatible with good surgery is a help by preserving an active laryngeal reflex.

While serving in one of the base hospitals in France during the war I had the good fortune to be associated with Dr. Kazanjian, of Harvard University, who was in charge of a special department for the treatment of gunshot wounds of the jaws. Many of the patients required operation at an early date on account of associated injuries, for multiple wounds from shells and bombs were common, and we soon found that the administration of a general anæsthetic in these cases of buccal and pharyngeal wounds was fraught with great danger unless special precautions were taken. Septic broncho-pneumonia, abscesses in the lung, and empyemata were not infrequent sequelæ. We therefore adopted the following precautions in those cases in which a general anæsthetic was necessary. Half an hour before the operation a hypodermic injection of atropin (gr. $\frac{1}{100}$) was given in order to diminish salivation, but no morphia was injected. The mouth was rendered as clean as possible just before the patient was taken to

simple and straightforward, and the bowel but slightly injured by the strangulation. But just after the bowel had been reduced the patient vomited, the vomit was inspired, she became cyanosed and died—in fact of drowning.

Desirable as it is to obtain the help of a skilled anæsthetist, this is not always possible. But whenever such a course is feasible the surgeon should endeavour not to be deterred from following it out. The medical practitioner who employs or recommends the surgeon often offers to give the anæsthetic, and it is not always easy to meet such an offer with a tactful negative. So far as the question of fees is concerned, the patient's doctor ought, in my opinion, to be present at any operation performed and to be properly paid for his attendance. But so far as an anæsthetist is concerned it is better for the reputation of all concerned that he should be a man who is thoroughly and continually experienced in the art of anæsthetisation.

Preparation of Patients for Anæsthesia

To say that the patient's nervous system should be calm and at rest before an operation would be trite enough, and with intelligent people about him or her, the end will in most cases be gained by simple and natural means. But there is a residue in which simple means do not suffice, and here a little dodgery sometimes may be called into play with good justification, such as the administration of the anæsthetic while the patient is so much under the effect of morphia as to

be unaware of the immediately impending operation. With proper care and prudence such a method is of great use, though there are obvious reasons why the method should be employed but rarely and only under the stress of unusual circumstances and with proper safeguards.

Provision should be made that the stomach, rectum, and bladder be empty at the time of the operation, both to avoid their involuntary evacuation during or after the administration of the anæsthetic, and also because when they are full they help to cause pressure on the diaphragm and so to hinder the heart's action. At any rate, whether by pressure or by reflex action, we know that these organs, when full, place a handicap upon the patient.

I met a friend of mine, a doctor, coming out of a dentist's house where he had just had a tooth extracted under ethyl chloride anæsthesia. He was in great distress; and not without reason. Having been busy doing his morning round of visits before keeping his appointment with the dentist, he had forgotten to empty his bladder before having the anæsthetic; with the result that the bladder took the opportunity when he was under the short anæsthetic to empty itself.

When operations are arranged in advance, an aperient should be given two days before that fixed for the anæsthetic, and an enema should be given on the evening before the operation. This will not lead to disturbance of the patient's rest on the night before his ordeal. But if time presses, and there is no interval of two days

before the operation, it is well to be content with an enema. Too much zeal is apt to be bestowed upon this matter of emptying the patient's bowel by means of aperients.

Excess of zeal also is often shown in the endeavours used to keep the stomach empty, with a twofold danger. The minor danger is the asthenic condition in which the patient has to face his ordeal, the major one is the peril of acetonuria.

Acetonuria

My impression is that acetonuria is more common among private patients than among hospital patients, and that hospital statistics are not a safe guide to its frequency.

Perhaps there is a reason for the condition being more common among private patients than among those attending the voluntary hospitals, inasmuch as the former lead less strenuous lives, are more warmly clad, and eat a larger amount of fatty and nitrogenous food. At any rate, the condition is one upon which earnest attention should be bestowed, for it causes the loss of many lives every year.

Without entering minutely into the physiology and pathology of acetonuria, we may say in general terms that it is due to a defect of the glycogenic function of the liver. If a healthy individual, and especially a young individual, be starved, or still more if he be fed upon fatty and nitrogenous food which contains no carbohydrate material, sooner or later he will develop a condi-

tion of acidosis, and this will be evidenced by the presence of acetone and diacetic acid in the urine, by a peculiar odour of his breath, and, if food is being given, by vomiting. If these conditions which have produced acetonuria be continued, he will become jaundiced, comatose—the coma being preceded sometimes by a condition resembling hysterical excitement—and will die. If, however, he be given carbohydrate food, probably his stomach will not reject it, in which event he will forthwith recover. Failing the administration of carbohydrate food by the mouth, he may be saved by the subcutaneous and rectal injections of a solution of sugar in water (a strength of 5 per cent. should be used).

Chloroform and other anæsthetics, either by suspending metabolism, or by interfering with the vital activity of the cells of the liver, kidney, and other organs, favour the onset of acetonuria. But anæsthetics are not the cause of the condition. Shock, for similar reasons, favours acetonuria. But shock is not the cause of the condition. Lack of carbohydrate food is the true cause. Excessive zeal in starving the patient before operation is a cause, feeding him on milk, beef tea, and albumen water is a cause; and these are the things we must specially guard against. Moreover, when a patient has persistent vomiting or develops hysterical excitement or coma after an operation, we should examine his urine, if we have not done so already, for the presence of acetone and diacetic acid, and make sure that he is not suffering from carbohydrate starvation.

These remarks do not have full application to the

acetonuria of diabetes and cirrhosis of the liver. In the former case the hormone which enables carbohydrate food to be utilised for neutralising the toxic substances brought to the liver by the portal vein from the intestinal canal is absent, whilst in the latter the diseased liver itself is incompetent to perform its proper functions.

The two essential facts to remember are, firstly, that acetonuria is caused by carbohydrate starvation, *especially if fatty and nitrogenous food be given at the* same time that carbohydrates are withheld; and, secondly, that it can be cured by timely feeding with carbohydrate food. Its diagnosis and treatment will save many lives.

Illustrative Cases

I was asked to see a small boy who had fallen off a wall a few days previously, bruising his head. He had not suffered any immediate ill effects, but some hours after the fall he vomited, and had been persistently vomiting ever since. On account of the drowsiness and vomiting it was thought that he might have sustained a depressed fracture of the vault of his skull with pressure upon or injury to the brain. However, he had marked acetonuria, and his symptoms disappeared rapidly and entirely after a carbohydrate meal.

In another case the patient was a much-pampered little girl who was thought to have appendicitis. She was suffering from persistent vomiting with drowsiness. The mother had been instructed to give her nothing but albumen water but she "brought up even that." She had some abdominal tenderness, most marked in the

upper part of the abdomen and due probably to the straining efforts of emesis. Her urine gave a pronounced diacetic acid reaction on adding a few drops of *liquor ferri perchloridi.* I ordered the immediate administration of a crust of bread, which she ate after a little persuasion. She had no more vomiting, and her symptoms disappeared forthwith. On inquiry into her ordinary diet I found it to be clearly deficient in carbohydrates. She habitually had meat soup for breakfast, and for tea had an egg with thin bread and butter.

There was a danger in both of these cases that an unnecessary operation might have been performed with a likelihood of a fatal issue owing to the acetonuria passing undiagnosed. In all such cases it is essential to warn the parents about the condition of acidosis and its cause. Because, unless the child's diet be revolutionised the symptoms are apt to recur and to be mistaken for some other condition with serious consequences. Moreover, special care will be required to avoid acidosis if any operation is subsequently required for the child.

A belief is present that acidosis is observed more frequently after chloroform than after ether has been administered. This may be so. Chloroform may possess a greater power than ether to injure the hepatic cells which neutralise the intestinal toxins, or the renal cells which excrete them. Probably anæsthetisation by nitrous oxide with oxygen is less damaging to the tissues than ether or chloroform, a thought which is not without obvious significance. But it must ever be borne in mind that the fundamental cause of acidosis is not the

anæsthetic, however much this may contribute to the manifestation of the condition. Given the presence of the fundamental cause, and the patient will get acidosis after taking chloroform, ether, ethyl chloride, or nitrous oxide; or indeed without taking any anæsthetic at all.

In conclusion, it may be said that foresight should be used in all cases of operation to avoid the onset of acidosis by omitting to prepare the patient by starvation; *he should be appropriately fed with a due proportion* of carbohydrate in the food. Secondly, in all cases of persistent vomiting, drowsiness, or coma, following an anæsthetic, the possibility of acidosis should be borne in mind and the urine examined for diacetic acid and acetone. *Lastly, the patient should be given a food containing* starch or sugar as soon as the immediate effects of the anæsthetic have passed off. I like my own patients to have toast water for their first drink. If for any reason food cannot be given by the mouth, then rectal injections *of sugar dissolved in water should be administered.*

Two of the examples I have given are not cases of post-operative acidosis, and for this reason, that although acidosis is a common sequel to operations and is therefore dealt with in this chapter, I do not wish to convey the impression that it occurs only after anæsthesia. The condition was first described adequately by Guthrie under the title of "delayed chloroform poisoning," and it is after operations that the majority of cases occur. But this incidence is casual and not essential.

With regard to the curative effects of sugar injections, I have known recovery to be procured in this way in

an adult who had reached the stage of coma and jaundice after an operation for the relief of an appendicular abscess. In this case the sugar was injected subcutaneously as well as into the rectum.

Pancreatin has been recommended as a measure of treatment, but I have no personal knowledge of its efficacy.

The effect of starvation in bringing about acetonuria and the sweet odour of the breath which is an accompaniment, has been made use of to interpret the ancient phrase "odour of sanctity." Through mortification of the flesh by starvation was this holy odour attained.

Post-anæsthetic Vomiting

Apart from acidosis, retching and vomiting after anæsthesia may cause the patient considerable distress, and his medical attendant some anxiety. The chief cause of this sickness is irritation of the gastric mucosa by direct contact with the anæsthetic drug, and post-anæsthetic vomiting may be quite prevented by lavage of the stomach with hot water before the patient leaves the operation-table, though, as a routine measure, there are objections to this plan of treatment. Occasionally the method may be of great service.

By administration of morphia and atropin one hour before an operation the tendency for vomiting to occur afterwards is greatly reduced; possibly because there is less salivation, and therefore less chloroform or ether is carried into the stomach through the patient swallowing his saliva.

If, however, morphia has been injected previously to an operation there may be difficulty in pushing the anæsthesia to a high degree owing to the depressant action of the morphia on the respiratory system Omnopon is said to have a less effect than morphia in causing respiratory depression

Light anæsthesia, especially with ether, is more apt to be followed by vomiting than is deep anæsthesia, as, in the latter, the swallowing reflex is abolished To some extent the swallowing of saliva during anæsthesia may be prevented by keeping the patient's head as low as may be convenient, with his face turned to one side so that the ether laden saliva may escape from the mouth without passing down into the stomach

Another precaution against post-anæsthetic vomiting is to avoid, so far as possible, all jolting of the patient after the operation, and any necessary movements should be carried out most quietly and gently With the same object in view, the patient should be allowed, so far as possible, to sleep off the effects of the anæsthetic, and no stupid attempts should be made to rouse him into untimely consciousness by slapping his face or applying any such physical stimulation

Other causes than physiological ones may be responsible for post anæsthetic vomiting For example, this may be merely a continuation of pre existent symptoms due to a continuation of the original disease, as in cases of uræmia, peritonitis, unrelieved intestinal obstruction But there is one especial cause that should be noted in connection with abdominal operations, namely, the

effusion of blood into the peritoneal cavity. The true cause in these cases is apt to be overlooked. A woman has some intrapelvic operation performed, and suffers afterwards from restlessness and excessive and continued vomiting. As likely as not the symptoms are attributed to hysteria or neurosis, whereas in fact they are due to intra-abdominal hæmorrhage through a failure in the surgical technique employed. A residual pelvic abscess is another cause of similar symptoms.

In all cases of excessive post-anæsthetic vomiting, especially if proper precautions to prevent it have been taken, an organic cause is to be suspected if acidosis and uræmia have been excluded by examination of the urine.

I am reminded by Mr. Harold Drinkwater of a not unimportant fact connected with the administration of nitrous oxide gas to young women, namely, that if a period be about due, the giving of gas may bring on the flow at once, even before the patient has time to reach her home. Such an inconvenience is easy to avoid if the possibility of the phenomenon be not forgotten. Also, and for a comparable reason, nitrous oxide is not a suitable anæsthetic to give to a patient who is in the early months of pregnancy, for abortion may be brought about thereby.

CHAPTER XXXIV

ACCIDENTS OF THE OPERATION ROOM

NOT a few of the troubles which may fall to the operating surgeon, and which do not find a convenient place elsewhere, can be discussed under this heading; though several cognate misadventures are mentioned in the section on Anæsthesia.

Failure to defend the Patient against Sepsis is the first. And our arrangements to secure the cleanliness of the wounds we inflict cannot be too careful. Such arrangements are sometimes described as "ritual," but it is to be hoped they never will have a general right to that title for it entails the abrogation of individual intelligence. Yet I have seen a surgeon amputating a limb on account of a large infected wound. The incisions which he made were in close proximity to this wound, and the danger of contamination was clear enough. The surgeon was washed and gloved and clad in correct "aseptic" fashion, and to this no exception could be taken. But what did arouse my dudgeon was the absence of antiseptics. Saline alone was used. He disapproved of disinfectant solutions for application to wounds. In other words, the technique which he employed was a ritual, and the rites were invariable.

Lister, in demonstrating the effects of phenol when applied to infected wounds, showed to the world an everlasting truth; and everlasting truths are always worthy of understanding and respect.

However, I wish in nowise to suggest that rigid rules can be abolished; such an attitude would be preposterous. I merely mean to advocate a little pliability in selecting and adapting the means we may employ toward the particular case with which we have to deal.

I once saw a severe outbreak of sepsis in a hospital, and among the cases was a fatal septicæmia following circumcision, and a pyæmia following the removal of some varicose veins. These operations had been done on the same day. The ensuing investigations led to the discovery that the steriliser used for the towels and dressings was defective, no increase of pressure being possible, with the consequence that bacterial cultures placed in dressings in the steriliser and submitted to the steam for a proper interval, were found on examination afterwards not to have been killed, while a raw egg which had been enclosed in the towels was not even "hard set."

Faults due to Assistants.—The fewer the individuals employed in an operation, by so much the fewer will be the sources of fallacy, so long as there is no actual deficiency of skilled help. One always feels a little anxious and uneasy when obliged to operate with the help of a stranger. An inexperienced assistant, unobserved, may slip a small detached swab into the abdomen during

a laparotomy, with the result that the operation is completed before the loss of the swab is discovered But the responsibility for such an oversight lies entirely *with the surgeon*, *and it is he upon whom* any resulting claim for damages will fall, and his is the reputation which will stand the chance of any consequent dilapidation One has known a strange assistant, during an operation for excision of the appendix, stoop down and with his gloved hand move the bucket for soiled dressings to a more convenient spot!

The remarks which have been made already as to the patient's private doctor administering the anæsthetic, apply with equal force against his acting as assistant Exceptions may be made, of course, but none the less the rule ought to hold good in the interests of every one concerned

Accidental Burns—An accident which is not unknown in operation theatres and during the patient's recovery from anæsthesia in bed, is the unguarded application to him of a hot-water bottle with the result that he is burned, perhaps very badly burned This is not likely to happen *when the nursing is in the hands of the skilled* and well trained women whom the surgeon is accustomed to employ, and the mishap illustrates the risk of employing strange nurses to look after the patient

A new nurse once let me down badly by handing me a bowl of liquid carbolic acid when I asked for catheter lubricant I detected the error only by the visible and striking action of the carbolic acid upon the unfortunate man's glans penis and urethra

Accidents due to Unfamiliar Surroundings

Operations in the patients' own homes nearly always bring anxiety, both because the surroundings are not under the surgeon's control and also—though this is a minor reason—because the impedimenta have to be conveyed to the house, and it may always happen that some necessary article is left behind. A surgeon went into the country to perform an urgent operation, and when he arrived at the house he discovered that no scalpel had been included among his instruments. In another instance during an operation in a private house the surgeon found in the middle of the operation that he had forgotten to bring any material for ligatures or sutures. That such things should happen seems absurd: but surgeons are apt to be tired and harried, and in these circumstances forgetfulness is possible to any man.

The increased risk of sepsis when operations are performed in a private house are manifest, and they arise not alone from the difficulty of securing unimpeachable asepsis during the operative manipulations, but also from the difficulty of controlling the patient and his friends and relatives from infecting the wound subsequently. Moreover, the lighting and heating of the room in which the operation is carried out are apt to be defective.

Use of Unfamiliar Instruments.—Many most lamentable accidents have occurred through unfamiliarity on the part of the surgeon with certain instruments. Thus

the sigmoidoscope has on several occasions been th
through the wall of the rectum into the perito
cavity; while lithotrity in the hands of the inexpert
provided many disasters through injury to the wal
the bladder. I witnessed a difficulty which might
regarded as comic, for no harm came by it to the pati
Happening to walk into an operation theatre I fo
the house-surgeon with a look of acute embarrassm
on his perspiring face. He had introduced a urin
segregator into a bladder, and found that he could
withdraw the instrument, the rubber diaphragm
which he had quite forgotten to relax.

New and complicated operation tables have ad
their quota to the catalogue of surgical mishaps.
a certain type which is adapted to lowering the patie
head, *care has to be taken while the table is being til*
to support it with the hands, otherwise the head
will go down with a bang and the patient will be thro
head first on to the theatre floor.

In order to keep the patient warm during an operat
various devices have been used. But of whatever nat
these may be especial care must be taken to avoid burn
the patient, who being anæsthetised cannot prot
himself. I have heard of a most unfortunate case c
nected with a new electric heater applied to the ta
of an operation room.

While patients are being lowered from the Trendel
burg position they may receive nasty injuries to th
hands and fingers through these getting pinched in t
table. A look-out must be kept to avoid this, and a

to prevent pressure palsies. The commonest of these affects the musculo-spiral nerve and is due to compression of this by the edge of the table—the arm having been allowed to hang down during the operation. I have been informed of a case of this kind in which the paralysis persisted for years; the operation had been a prolonged one. Another kind of pressure palsy is that in which the brachial plexus is injured owing to the arm having been kept abducted or extended above the head, and externally rotated.

The best position for the arms during an operation, in view of these risks, is close to the patient's side where they may be fixed by placing each hand beneath the corresponding buttock.

Difficulties due to a Bad Light.—Naturally enough, except in a properly equipped operation theatre, trouble may arise through defective lighting, and the surgeon should make preparations against these troubles. Even in regular operation theatres the matter should be considered of the provision of an alternative illumination lest the ordinary supply should fail at a critical moment. On one occasion, prior to the war, I was operating upon a strangulated hernia at night. I had just opened the sac when out went all the electric lights of the district. Both the anæsthetist and myself passed a most uncomfortable and seemingly very long time during the improvisation of a substitute.

Foreign Bodies introduced by the Surgeon and Lost in the Patient's Body.—The discovery at some date subsequent to a laparotomy of a pair of pressure forceps

or a swab in the patient's abdomen is an event to which the public press has in the past and will in the future devote considerable attention. But the abdomen is not the only receptacle for lost swabs; for these have been left by oversight in the lumen of the bowel where they had been placed during a resection of intestine, in the gall-bladder, and even in tissues where there are no natural cavities, as the following example will show. A case of osteomyelitis of the humerus had been operated on and the outpouring of pus had continued in a very generous manner. I therefore started to explore the wound, and the first thing I found was a swab which clearly had been introduced at the previous operation and forgotten. Satisfied that the free flow of pus was to be attributed to the presence of this foreign body I removed it and did nothing more. However, the suppuration continued with unabated freedom, so I carried out a further exploration and found another swab!

Drainage tubes, unless properly secured, are especially apt to slip out or to slip into a wound instead of remaining where they are intended to remain. Only the other day did a case come to my knowledge in which a rubber tube used to drain an empyema had slipped into the chest. On taking an X-ray photograph prior to an operation for its extraction two drainage tubes were discovered in the pleural cavity. Inexperienced nurses will sometimes assume that because the drainage tube is no longer to be seen it must have come away with the dressings.

I removed the submaxillary salivary gland of a lady

on one occasion for chronic suppuration, and inserted a small tube, giving instructions that it might be removed at the first dressing forty-eight hours later. I did not fix the tube in any way nor did I carry out the after treatment, as the nursing home was a good distance away. However, after some weeks I heard from her doctor who said the patient was all right and the scar was satisfactory, although he had been obliged to make another incision in order to remove the drainage tube! Of course, that was a very long time ago.

Section VII

CHAPTER XXXV

A GENERAL CONSIDERATION OF THE SOURCES OF SURGICAL ERRORS

The Thames is said to arise in the Cotswold Hills, and yet a very small proportion of the water that flows beneath London Bridge has come from Gloucestershire. Nor would it be possible to take a sample of the water at Battersea and to say whence it had come. In a similar way the commitment of a surgical error is usually a complex affair derived from such a mixture of causes that any logical classification seems impracticable. Therefore the geographical method of description will be adopted here. That is to say, the main tributaries of the stream of error alone will be discussed, leaving the multitude of minor runnels to the reader's imagination.

These main tributary streams are four in number, and are Ignorance, Carelessness, Misjudgment, and Defective Technique.

I. Ignorance

At the first glimpse it may be thought that all mistakes can be attributed ultimately to ignorance.

But this certainly is not true. In fact, the greater number of surgical errors which we can recognise as such are largely or entirely the outcome of causes other than want of knowledge. Ignorance is, of course, merely a relative term. With our limited powers of cerebration, and while awaiting the advent of universal wisdom and truth, we can only establish, each man for himself, a certain arbitrary standard and regard it as the dividing line between knowledge and lack of knowledge.

No one, it may be imagined, would regard the following errors as lying well above the line of legitimacy, and yet they were both committed by men who were able to prosper in the exercise of their profession.

A child was taken to her doctor with the information that she had got an imitation pearl bead in the ear. The doctor, after ineffectual attempts to remove the bead without and with the help of anæsthesia, sent the child to hospital, where she arrived somewhat shocked and with blood issuing from the external auditory meatus. Examination revealed a lacerated tympanum but no foreign body. The mother, on being requested to produce the beads with which the child had been playing, brought to the hospital a box of tiny beads not one of which was nearly large enough to lodge in the meatus of the ear.

Another case was that of a married woman who was sent to hospital with a note from her doctor in which he stated that she was "suffering from retention of urine probably due to an enlarged prostate." At any rate the case "was not one of ordinary stricture"—

the district nurse having been able to draw off the urine with a rubber catheter. The patient had previously, he added, undergone hysterectomy. As a matter of fact she was suffering from retroversion of the pregnant uterus.

Three main sources of surgical ignorance can be recognised, and these are—(*a*) defective foundational instruction, especially in physiology and anatomy; (*b*) neglect of post-graduation study; and (*c*) want of experience.

I suppose it is evident that an *absence of basic information* is never likely to be made good, once a man has launched himself into practice. Opportunities will be lacking while the capacity to learn will be already fading away. And as no man can ever reach high scientific levels unless his foundations are sound and substantial, his opportunity will have been for ever missed, if he has neglected the preliminary subjects of anatomy and physiology. Truly, his money-making faculty may not be abated, but that is another thing altogether.

The neglect of post-graduation study is, unfortunately, a widespread malady. For, unless a man is inherently keen and has a soul that soars above his bank, there is small need for him to keep abreast of modern progress. The public are so lacking in discernment that it matters not how much or how little a man may know provided he has the qualities of plausibility and persuasiveness; while so far as cerebration is concerned, it is as easy to earn an income from a panel practice as it is to turn the handle

of a barrel organ. In saying this I do not in the least wish to appear in opposition to the panel practitioner. Some of the best men in the profession have panel practices. But I do think that in the interests of civilisation it is lamentable that a public service has arisen in our midst in which ignorance and wisdom are rewarded alike, and in which a cynical disregard is shown for the sacrifices that must be made by any oné who tries to reach a high level of attainment in his profession.

Want of experience is not to be remedied by the lapse of time alone. Opportunities for gaining experience are required. And this is one of the troubles that afflicts nearly every young surgeon, that in the early days while he is still young and his powers of acquiring knowledge and manual dexterity have not yet waned too far, he is robbed of almost every chance of gaining a full and generous experience. The main service of hospital beds is reserved for the use of men to whom the opportunities for experience thus provided can be of little use.

This disadvantage is not easy to overcome by literary studies; for too much of the material which appears in the periodical press is tinged with the spirit of advertisement, and so embodies the intrinsic defects of an *ex parte* statement. The only tabulation of results which is worth serious attention is one which is compiled quite independently of, and uninfluenced by, the surgeons who performed the operations.

And another fallacy connected with surgical publications is the fact that they are often, if not usually, confined either to special cases or peculiar circumstances,

or to the achievements of some expert as recounted by himself; consequently they cannot be relied upon as representing the average case treated by an average surgeon.

Indeed, the rebuke of the wise is a good deal less audible therein than is the song of fools.

The fact that the well-known so-and-so has successfully operated upon fifty patients suffering from trigeminal neuralgia, by resection of the Gasserian ganglion, with only two deaths, should convey no feeling whatever of self-confidence to the young surgeon who has had no personal experience of this operation. If he undertakes its performance, more than likely he will kill the patient, or fail to resect the ganglion or the portion of it which he wishes to resect, or else cause a cerebral injury, an intracranial aneurism, or some other of the complications which are apt to accompany this difficult operation.

The truth is difficult to acquire. Even to study a good operator at work is not sufficient; like the current literature, he teaches but half the lesson. For it is necessary to learn not only what ought to be done and how to do it, but also to discover what ought not to be done. Indeed, it frequently is instructive to observe the work of a bad surgeon, though the process may be painful and trying to the temper. The fact is we have a need of something akin to the Hippocratic oath in which the graduate physician declares, "Nor will I cut them that have the stone, but will send them to men whose work it is to perform that operation."

The laity are too ignorant to protect themselves from the surgeon who overrates his own ability at their cost. And as for him, who shall administer reproach? He does not measure correctly his own ignorance. None but the wisest of men can master such difficult arithmetic as that. This year's files of the *Times* will show some amazing examples; men with good intellects and world-wide reputations writing and appending their names to the utmost bosh. Doubtless it is this failure at self-assessment that leads so many general practitioners to "do their own surgery." Some explanation is needed, for the results collectively add little to the glory of the healing art. Surgery is such a jealous mistress that she requires from her devotee a whole and undivided service, and even so her demands can never all be executed with a sense of satisfaction from perfect fulfilment. There must be failures, partial or complete, even in the hands of one who is a surgeon first and last. The occasional operator is a public danger.

Humanity may or may not be advancing, and if advancing its progress may or may not be towards any particular and desirable goal, such speculations may be left to the metaphysicians. But this is certain, that the cult of surgery is undergoing a swift and incessant change, and what was good practice last year is out of date this, and will be malpraxis in the year that is immediately ahead.

The custom of packing a septic wound with gauze is an example; a little while ago it was regularly practised without an audible dissentient voice. Now

the method is out of date; because the special aims which the gauze packing was intended to achieve, namely, drainage and healing from the bottom, can be achieved by methods that are less cruel and more efficient. Still, there probably are many surgeons even in this year of grace who are old-fashioned enough to employ wound packing in spite of the fact that it hinders rather than encourages drainage, and in spite of the fact that it leads to much suffering on the part of the patient.

Incorrect teaching doubtless shares with inability to learn the responsibility for many of those surgical errors that may be discussed beneath the title of ignorance. Several instances will be found in illustration of this in the chapter on Amputations. The initial fault is difficult to overcome and can be remedied only by the surgeon thinking and observing for himself. Respect and attention to dogma without any blind acceptance is the correct attitude. As the late Mr. C. B. Lockwood was fond of telling us, " the temple of Science is entered through the portals of doubt."

Not much need be said upon the occasional failures to recognise rare or newly described diseases. Every one is tripped up now and again by some rarity which he fails to diagnose. An elderly patient comes with certain abdominal pains, and on examination we find a hard, nodular mass in the right iliac fossa. We judge this to be a carcinoma of the large bowel, and as the mass is fixed and there are evidences of involvement of the encompassing structures, we decide that the prospect of any successful operative interference is unfavourable.

We give our prognosis accordingly. Time drifts by and the patient leaves the town or, worse still, seeks further medical advice from our rival. By this time a sinus has formed in connection with the tumour, and the new doctor has the discharge examined by a pathologist. The disease turns out to be actinomycosis, and our reputation suffers a reverse.

Here is another example. The house-surgeon one evening asked me to see an elderly man who had been sent to the hospital with a note from his doctor saying that he had a bone in his throat which the doctor had been unable to extract. The patient had been seized with sudden pain near the angle of the mandible on the right side while eating some meat. A little blood was oozing from the right tonsil which was swollen and plum coloured, while a sharp fragment of bone could be palpated within its substance. Like the patient's own doctor and the house-surgeon before me, I supposed that a piece of bone had become lodged in one of the tonsillar crypts, from which I made painful and ineffectual efforts to extract it. At last, with the aid of local anæsthesia, I was able, not to expose or to grasp the bare fragment of bone, but to get hold of this together with the portion of tonsil in which it was embedded; it then became apparent at once that the supposed foreign body was attached firmly to the base of the skull. Presumably the patient had been the possessor of an ossified stylo-hyoid ligament which had become fractured —an accident that was quite new to my experience.

We shall never escape altogether from misadventures

of this kind, however hard we try. But we render them less likely by keeping ourselves alert. We should treat our minds as the good horseman treats his horse, who when in the saddle will keep his mount awake. Even a new and hitherto undescribed disease need not cause us disaster then.

II. Carelessness

It may be only an impression, but it is a strong one, that carelessness is responsible for more of the mistakes that are recognisable as such, than is mere ignorance.

Imperfect Collection of Evidence is at the root of a great percentage of errors. How often one sees a case that has been diagnosed as malaria merely on the presence of *pyrexia and a history of residence in the tropics*: the clinical and pathological examinations required to establish such a diagnosis and to eliminate other diseases —tuberculosis, for example—having been partially or wholly ignored. Failure to co-operate with the clinical physician, the pathologist, the radiographer, and so forth —neglect of team work—is the cause of many, and perhaps of most, of the disasters of surgery.

Nor is such a lack of co-operation the only way in which useful evidence may remain unavailable. The surgeon only too frequently curtails his own examination of the patient within limits which are too narrow. So he performs a laparotomy upon a patient who has acute abdominal pain and finds no adequate lesion within the peritoneal cavity; later on—perhaps in the post-mortem room—the empyema which caused the symptom

is discovered. Or a patient who has a swollen knee is under examination, and the other knee of which no complaint is made is not laid bare for comparison with the one which is bad, and consequently a symmetrical lesion of both knees is completely overlooked. Such omissions in the clinical examination of patients are too numerous. In part they are attributable, no doubt, to a reluctance to cause a lot of disturbance to a patient who already is in much distress. Or they are due to haste, especially with that type of surgeon to whom "bluff" has become a habit; for a patient is nearly always well impressed by a rapid diagnosis uttered with a tone of absolute conviction; and the "bluffing" surgeon lays great store on impressing the patient with his ability and strong individuality. But most often these omissions must be laid at the door of pure carelessness.

Occasions there are when delay would be fatal, and risks have to be taken deliberately. For example, it is always desirable, if a patient has undergone a previous operation, to know exactly what condition was found and what treatment was adopted. And yet to delay active measures while awaiting such desirable information may be fatal. However, unless the matter is urgent, the previous case-notes always should be obtained.

A girl, suffering from otitis media, underwent an operation in the course of which a subdural abscess was found, and a portion of the bony wall of the middle fossa of the skull was gouged away in order to remove infected bone and to secure drainage. A few weeks later another surgeon saw the girl, who was still complaining of some

giddiness. This surgeon, without reference to details of the previous operation, had the anæsthetised, reopened the wound behind the ear, with a gauze swab held in a pair of pressure foi commenced to scrub away the granulation tissue v of a sudden both swab and pressure forceps plu: through the softened dura mater and entered de into the patient's brain.

There was no need for this fatal haste, and reference to the previous case-notes disaster would l been avoided.

At the same time a warning must be given aga too much deliberation, and too detailed a collec of evidence, whereby a broad, well-balanced, and com hensive survey of the case will be prevented. Indivi features have to be observed in their proper pro tion only; it is the subconscious summation of t features upon which our final judgment will rest; it is to be noticed that the over-meticulous surg whether in diagnosis or in operative work, will ofte beaten in results by a competitor who depends ra more upon "flair." The Chinese have a proverb to effect that he who deliberates fully before taking a s will spend his life standing on one leg—a saying wl is germane to surgical as well as to most other hur decisions.

One contributory cause of the imperfect collect of evidence is inaccuracy on the part of the surg himself, the patient, or the patient's medical attenda

Patients' statements, speaking in a general w

are notoriously unreliable, and it is seldom safe to base active treatment upon them unless they can be verified. Quite a commonplace example is that of a patient who complains of hæmatemesis and who, after admission to a nursing home, is found to bring about emesis by introducing a finger into the pharynx and to obtain the necessary blood from her own gums.

Misinformation by a fellow medical man is a much worse obstacle to good work; and some individuals, in spite of their long professional training, are constitutionally incapable of accuracy. At a consultation on one occasion I was told by her doctor that the patient's urine was "loaded with pus." Investigation showed, however, that there was no pyuria, a heavy deposit of phosphates having been mistaken for pus. When I mentioned this, he fixed me with a fierce and combatative eye, loudly proclaiming, "We haven't time to examine the urine; we have not time." A statement which appears to be perfectly true.

III. Errors of Judgment

Why do we make so many errors of judgment? Partly, no doubt, because we lack experience and knowledge; but these deficiencies, probably, are less common causes than those which are about to be discussed.

First of all may be placed a defective mental condition which is the consequence of *fatigue*. Weariness is a constant and peculiar enemy to efficiency: peculiar in this, that under its influence we sometimes perform the

most ridiculous acts and are quite unconscious of our folly. An obstetrician has told me apropos of this that he was called, upon one occasion when he happened to be tired out, to give assistance in a case of difficult labour. Unwittingly he attempted and, the child's head being low down, succeeded in applying the forceps backwards to the child's head, that is to say, with the convex edge of the forceps directed forwards.

The surgeon, having been called out to do an emergency operation at night after a very fatiguing day's work, returns to bed well satisfied with what he has done. He thinks he has operated well—nay, brilliantly. But to-morrow the cold truth will break upon him, and he will go about muttering to himself, "What on earth made me do this?" or, "How in the world did that happen?"

Worthless is the judgment of a tired man.

Bias is another obstacle to clear discernment, and it is one of which it is difficult to be rid. It has so many roots. Fear, desire, preconceived opinions, dogmas impounded in our minds as truths, obstinacy which forbids the admission of a mistake, the hope of reward—these are some of its roots; and there are others. We have all met the over-conscientious, nervous individual, who through fear of aiming too much toward the left misses the target widely on the right.

One especially dangerous form of bias is that which accompanies all concentration of thought. When the mind's eye is fixed intensely upon one point the remaining field of vision becomes obfuscated, and features that to

the casual onlooker would be patent, are overlooked by the wrapt observer. This source of fallacy has been mentioned on another page, where the desirability of broad and comprehensive views are advocated. But particular examples may be mentioned in this place to give point to the general argument.

A man met with an accident and broke his right leg. He was taken to hospital, where the fracture was set under anæsthesia. On the following day he had much abdominal pain and vomiting, with tenderness in the right iliac region of the abdomen. However, to cut a long story short, the surgeon was so much preoccupied with the fracture that he did not pay as much attention to the abdominal symptoms as they deserved, and in the end the patient died of peritonitis due to a lesion of his appendix.

Here is another instance. A somewhat plump young woman was seized with acute abdominal pain, and at once came under the care of a surgeon who found she had a large, hard, tender swelling in the pelvis. An operation was performed with the patient in the Trendelenburg position, and an ovarian tumour with a twisted pedicle was removed under the impression that this must be the cause of the symptoms. The operation brought no relief, and the patient succumbed to general peritonitis brought about by the perforation of a duodenal ulcer. Had there been no tender lump in the pelvis there is hardly a doubt that the duodenal lesion would have been recognised and correctly treated.

This essential fallacy which is due to fixity and

intensity of vision does not require the coincidence of two separate lesions for its full play. It often comes into work where there is but one lesion, the surgeon in this case being led astray by concentrating too much attention upon some individual symptom or physical sign, instead of taking a comprehensive survey of the whole pathological field. I visited an operation theatre on one occasion when an operation for gastro-enterostomy was in progress. The patient—an elderly man—was pale and emaciated and his temporal artery proclaimed to all beholders the presence of arterio-sclerosis. No demonstrable lesion was found in the stomach. The vomiting, epigastric tenderness, and indigestion were the accompaniments of uræmia which would have been discovered readily enough had not the gastric symptoms attracted the whole of the surgeon's attention.

Timidity.—Courage is an essential ingredient in the character of a surgeon. By this I do not mean the ruthlessness that by some people appears to be synonymous with courage, or "the big voice, big chest, big merciless hands" that have been affixed to the surgeon in particular by Tennyson; but the quiet firmness of character that cannot be deterred from the proper course by the chance pressures of irrelevant circumstance. To give opinions and advice which are welcome to the recipient is so much easier than to impart evil tidings; to "wait and see" in preference to taking a bold but correct decision, merely because the nature of the case renders it impossible to be sure that such a decision will be attended by success, is such a strong temptation that

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This essential fallacy which is due to fixity and

intensity of vision does not require the coincidence of two separate lesions for its full play. It often comes into work where there is but one lesion, the surgeon in this case being led astray by concentrating too much attention upon some individual symptom or physical sign, instead of taking a comprehensive survey of the whole pathological field. I visited an operation theatre on one occasion when an operation for gastro-enterostomy was in progress. The patient—an elderly man—was pale and emaciated and his temporal artery proclaimed to all beholders the presence of arterio-sclerosis. No demonstrable lesion was found in the stomach. The vomiting, epigastric tenderness, and indigestion were the accompaniments of uræmia which would have been discovered readily enough had not the gastric symptoms attracted the whole of the surgeon's attention.

Timidity.—Courage is an essential ingredient in the character of a surgeon. By this I do not mean the ruthlessness that by some people appears to be synonymous with courage, or "the big voice, big chest, big merciless hands" that have been affixed to the surgeon in particular by Tennyson; but the quiet firmness of character that cannot be deterred from the proper course by the chance pressures of irrelevant circumstance. To give opinions and advice which are welcome to the recipient is so much easier than to impart evil tidings; to "wait and see" in preference to taking a bold but correct decision, merely because the nature of the case renders it impossible to be sure that such a decision will be attended by success, is such a strong temptation that

a great deal of moral fortitude may be required in order to keep on the right road.

A patient has abdominal pain—a matter perhaps trivial, but possibly grave. It is essential to place such a patient without undue delay in surroundings where he will be under skilled observation and where suitable operative measures may be employed if they are found to be necessary. But to do this will entail a good deal of inconvenience and general botheration; moreover, the doctor may incur some ridicule if the transference of the patient to a hospital or nursing home proves to have been unnecessary. So that the temptation arises to let the patient take the risk in order to protect our own reputation; to wait until we are sure which way the cat is going to jump. But abdominal lesions are often hasty evils, and the case that was favourable yesterday may be past hope to-day.

So often do we wrap ourselves round in the tattered garment of infallibility rather than be seen by the world for what we really are; and not because we are modest, but because we are ashamed.

A baby—the firstborn of fond parents—suffered from congenital hypertrophic stenosis of the pylorus. No doubt existed as to the diagnosis, no trouble or expense was spared in a trial of medical therapy. The infant did not improve. A leading physician was consulted and strongly urged that an operation should be performed. But the family doctor, whenever an operation was proposed, advised deferring it just a

little longer in the hope that the tide would turn. His hope was not fulfilled; he waited too long and the child died of starvation.

Another kind of surgical occasion which calls for firmness of character is when at a critical moment during an operation some onlooker intervenes with an ill-timed remark. The effect upon the surgeon may be compared with that exerted upon a sprinter who happens to be jostled by a competitor in a hundred-yard race. Whether he deviates to the right or to the left as a result of the collision will depend upon whether action or reaction is the greater; but in either event his balance will be disturbed and his even stride be broken. In the case of the surgeon the disturbance caused will be proportional not only to his mental concentration at the moment, but also to his instability of character.

IV. Defective Technique

The Use of Unfamiliar or Unsuitable Tools may be made to account for a good deal of trouble in the practice of surgery. Perforation of the rectum with the sigmoidoscope, for example, has happened many times, and the lithotrite has been known to cause much havoc in the bladder.

Some years ago on arrival at the hospital one day I received an urgent summons to the operation theatre, where I found the house-surgeon in a state of great agitation. Having introduced a Luy's segregator into a patient's bladder, he was quite unable to withdraw the instrument. He had forgotten to wind down the

diaphragm by which this obsolete or obsolescent instrument divided the bladder into two compartments.

The use of unsuitable tools may be well illustrated by the operation of exploring for pus by the insertion of a hollow needle whose bore is too fine for the purpose. I have known instances in which abscess of the liver, purulent pericarditis, and empyema have been overlooked because the needle with which the abscess had been explored was too fine for the transmission of pus.

Lack of Manual Dexterity is of course a great handicap to a surgeon, and although manipulative skill is acquired with practice there are great variations in the natural capacity of different individuals. As a matter of fact, although the public are apt to regard the handicraft of surgery in the light of a consummate necessity, it is quite a secondary concern as compared with the attributes of knowledge and strong character. A clumsy person can be a fair surgeon, but no one can be a surgeon at all unless he has a good stock of anatomical, physiological, and pathological knowledge, and unless he has also those qualities of mind that enable him to make proper use of this knowledge. The calm, well-stocked brain is of much more consequence to the operator than the steady hand and wonderful dexterity that appeal to the popular imagination.

A reasonable celerity is never difficult to the man who knows what he is doing; at the same time rapid operating is not at all synonymous with good work. Attempts to impress observers by the speed of our performances are particularly obnoxious. Such *efforts*

at brilliancy are everlasting sources of error. Mistaking the ileum for the jejunum in a gastro-enterostomy, wounding the femoral vessels during operations for hernia, are examples. And when one hears a man boast that he takes only five minutes to perform a Cæsarian section, or six minutes over a prostatectomy, one can be pretty sure that the various complications that occasionally beset these procedures will fall with a heavy incidence on the clients of that boaster.

Sudden Emergencies.—The ability to surmount sudden and unexpected emergencies is dependent upon the experience, character, and knowledge of the surgeon who is concerned, and not upon uninstructed intuition. In this connection the following words of Napoleon are apposite. "I am always working," he says. "I think much. If I appear always ready to meet every emergency, to confront every problem, it is because, before undertaking any enterprise, I have long considered it, and have thus foreseen what could possibly occur. It is no genius which suddenly and secretly reveals to me what I have to say or do in some circumstance unforeseen by others; it is my own meditation and reflection. I am always working—when dining, when at the theatre; I waken at night in order to work."

Failure to Operate in Accordance with Anatomical Structure is a great source of trouble and disaster. Nor will it be right to suppose that such divarications from rectitude are most commonly due to ignorance of anatomy. The course of the external popliteal nerve at the level of the knee is well enough known, and yet

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it has been seriously injured by the knife in the course of subcutaneous tenotomy of the tendon of the biceps, during removal of an enlarged synovial bursa, and even in effecting drainage of the knee-joint on account of suppurative arthritis. Similarly, the superficial femoral artery has been cut during a tenotomy of the tendon of the adductor magnus, the vagus has been included in a ligature applied to the common carotid, and indeed innumerable instances of anatomical oversight such as the above might be quoted.

But there is another class of case in which there is serious neglect of important anatomical structures. The deep cervical fascia is of importance, and yet there are surgeons who habitually forget to suture this after having divided it during operations on the neck. The cavalier fashion in which oftentimes the structures of the abdominal wall are treated in the course of laparotomy and the ventral hernias which follow offer additional material for meditation in connection with this type of surgical shortcoming, which is hardly attributable perhaps to lack of manual dexterity, but nevertheless can be appropriately mentioned in connection with defects of operative technique.

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PRINTED IN THE UNITED KINGDOM BY
WILLIAM CLOWES AND SONS, LIMITED, BECCLES, FOR
BAILLIÈRE, TINDALL AND COX.